The AMSAT® Journal

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Recently at the Phase 3D Integration Laboratory, Phase 3D Project Leader, Karl Meinzer, DJ4ZC (l) accepted a plaque from AMSAT-NA Executive Vice President Robin Haighton, VE3FRH (r) on behalf of Werner Haas, DJ5KQ. Haas was commended for his many years of devoted service to the Amateur Radio Satellite fraternity including Phase 3D development. (Photo by Lou McFadin, W5DID)

Final Sprint for AMSAT Phase 3D

Peter Guelzow, DB2OS

Translation by John J. Bubbers, W1GYD

Editor's Note: The following article, which originally appeared in the AMSAT-DL Journal, provides a description of recent Phase 3D tests. Since the vibration test, Phase 3D has been readied for delivery to Kourou, French Guiana (see page 5).

In August 1999, a sizable AMSAT-DL group again traveled from Europe to the USA to prepare Phase 3D for the final vibration test at the NASA Goddard Space Flight Center. In a time

[continued on page 4]

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Apogee View

You Can Help!

AMSAT is one of the places where, over the years; ideas have been born and where the progress of Space Science can be measured. This year AMSAT is anticipating great things. The launch of JAWSAT and the associated satellites may have happened before you read this column. We hope soon to have indication from AMSAT-DL on the possible launch date for Phase 3D, which, by the time you read this, should be sitting in French Guiana awaiting the signal to start the launch campaign. The start of the Amateur Radio transmissions to/from the International Space Station (ISS) should commence in the first half of the Year, and be an auspicious beginning to a New Year.

All of this activity will require a lot of work by the AMSAT-NA Officers and Board of Directors. It will of, course, involve both additional expenditures and many hours of work from the volunteers in all aspects of AMSAT operations.

During the AMSAT-NA Board of Directors meeting in San Diego last October, it was pointed out that currently our dues barely meet operational expenses without any funding being available for new satellite operations.

Our dues have been fixed for the past twelve years while expenses, through inflation have continued to rise. The new rates, effective 01 July 2000, will be U.S. $36.00 per year; Canada $41.00 per year, and all others $45.00 per year (all in U.S. dollars). Until 01 July 2000 you will be able to join or renew for one more year at the current rates. These modest increases will provide some security for our daily activities and ensure that funds to be used for ISS and other satellite activities are not diverted to the running of the organization.

Now for the opportunities for the membership to become more deeply involved in AMSAT-NA, please keep reading!...

This aspect of AMSAT is of particular interest to me, as your Executive Vice President. I know that our members (reading this column now) come from many and varied backgrounds; some are highly skilled technically; some are considerably less technical but very capable of assisting in the administrative roles of an organization such as AMSAT-NA. Of course there is a majority of you who fall somewhere in between these two positions.

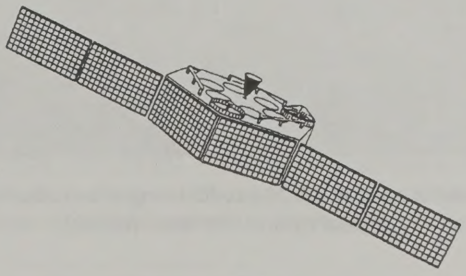
If you are interested in being a part of the AMSAT-NA organization, we are interested in you! Perhaps you are about to retire or take an early retirement - or perhaps as a new graduate you would like to get involved in detail design. For example we are even looking for a volunteer accountant/treasurer living within 50 miles of our Washington, DC office, and of course we are always looking for Area Coordinators - we cannot get too many of those.

Surprising as it may seem we are looking for members who one day will be eligible to be the President of AMSAT-NA. What would be your first step in becoming involved? Simple - just send me an e-mail (*ve3frh@amsat.org*) or write (2028 Cheviot Court, Burlington, Ont. L7P1W8, Canada) and give me a brief idea of what you would like to do. A bit of information about your background would help.

Oh yes, I nearly forgot - being retired is excellent, but then so is working. For my part I will send your information to the applicable AMSAT Officer who will contact you directly - just look at the current list of officers on page 2 - they all need your help. Lets get this going - If in doubt DO IT!

I did and I have never regretted it for one moment!

73 de Robin Haighton, VE3FRH



[continued from page 1] period of about four weeks, all subsystems, the satellite bus and all electronic units of the satellite were again tested, before and after the foaming of all modules. Similarly, all receivers and transmitters were tested again, as well as the travelling wave tube (TWT) with its greater than 60 Watt output power and both of the 21 MHz and 24 MHz shortwave receivers. The first communications with South American Radio Amateurs was made over the latter.

First PSK Contact on 24 GHz?

During the integration operations on the Phase 3D satellite on 10 June 1999 possibly a first worldwide PSK contact was achieved on 24 GHz. Danny Orban, ON4AOD, the builder of the Ka-Band transmitter and Peter Guelzow, DB2OS, the Digital Communications Manager and Phase 3D Command Station Manager, turned on the 24 GHz transmitter for further tests and antenna tune-up. The beacon at 400 Bit/s-PSK modulation was then switched on, and telemetry from the on-board computer was transmitted. The telemetry was received on 2 meters by means of a 24GHz-converter, decoded and evaluated with the ground command installation.

Dr. Karl Meinzer, DJ4ZC, the Phase 3D Project Leader, was highly pleased and said that this is probably a world record. This is again a living example of how Amateur Radio is always at the cutting-edge of technology.

Final Extensive Function Test of the Satellite-Bus

A major milestone was reached on 13 June 1999 with the successful ignition of the separation charges for the deployment mechanism of the solar panels, as well as a function test of the control electronics for the 400-N propulsion engine. Rick Leon, KA1RHL, who built the Array Release Unit (ARU) and the Liquid Ignition Unit (LIU) observed the faultless operation while Peter Gülzow, invoked the command station's computers to perform the simulation. The deployment mechanism, which was built by Bob Davis, KF4KSS, operated as designed, and after the command for ignition of the redundant separation charges was given, the solar panel opened. A Kevlar tie was cut which holds the solar panels during the launch and spin phase, was cut.

Roll-Out

A further milestone was the so-called *roll-out* in which all of the transmitters and receivers were tested with the antennas in the flight configuration. For these tests a team of experts and builders of the various transponders of the AMSAT Phase 3D satellite traveled from Europe. The group consisted of Matjaz Vidmar, S53MV, Mirek Kasal, OK2AQK, Michael Fletcher, OH2AUE, Wilfried Gladisch, Peter Guelzow, DB2OS, Werner Haas, DJ5KQ, and Karl Meinzer, DJ4ZC. Mireck's luggage wasn't able to make it to Orlando and was lost somewhere crossing the Atlantic Ocean. After two months it was finally found and returned to Mirek. It was most important to him because important technical papers and designs were inside his luggage.

The Phase 3D satellite was ready for the grand *roll-out* after tests of the mounting and the tuning of the antennas which were built primarily by Stan Wood, WA4NFY, and Freddy Guchteneire, ON6UG, as well as further functional transponder tests. A large tent was set up to protect the satellite from the weather (it was the rainy season in Florida) and to have better HF free-space conditions. That is where the Phase 3D was tested extensively for many hours and on many successive days. The antennas were optimized and additional band pass filters were installed to decouple several transmitters and receivers.

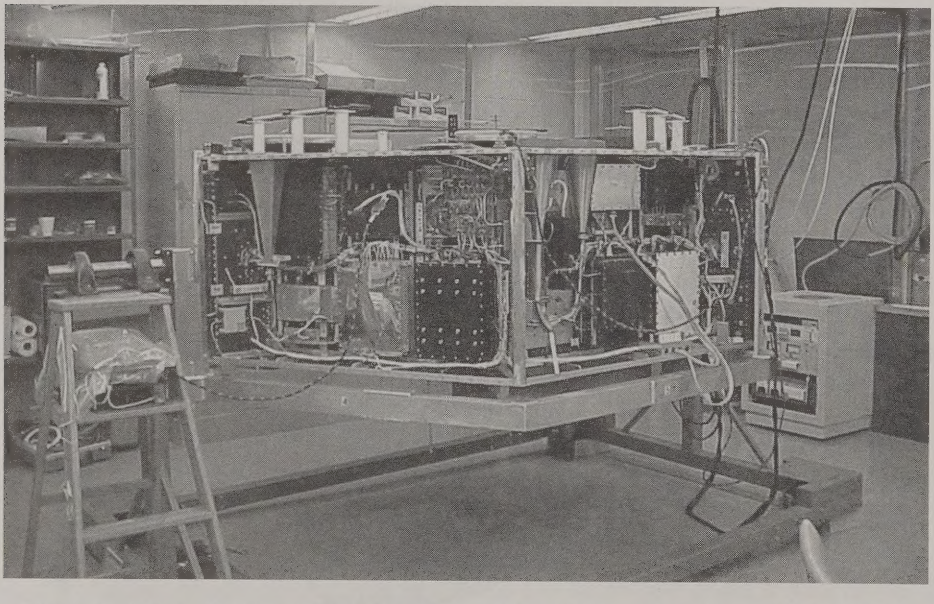
It was frequently necessary to roll the satellite back into the clean room because of thunderstorms, but in the end Werner Haas, DJ5KQ, who is responsible for all HF modules on the satellite, reported the successful conclusion of the tests and that all HF sub-systems operated nominally. The receivers are maximally sensitive, and by turning the antennas into the *cold* sky a reduction of the noise in the receiver's AGC could be clearly seen in the telemetry, for example.

Propulsion Engine Test

Another major event was the successful testing of the 400-N apogee thrust engine (DASA) and the 100-mN ATOS plasma propulsion engine from Stuttgart University, during which the entire piping system and the fuel tanks were pressurized with nitrogen, in order to test the control electronics and valves. The *test shot* was performed by Dick Daniels, W4PUJ, Rick Leon, KA1RHL, Karl Meinzer, DJ4ZC and Peter Guelzow, DB2OS, and performed according to specifications. The pressure sensors were simultaneously calibrated for the telemetry, and the *burn time* of the propulsion engine was checked.

In Space No One Can Hear You

One of the last chores was the installation and testing of the YACE camera as well as the microphone for the experimental IHU-2 (YAHU), which was conducted by Lyle Johnson, WA7GXD, Chuck Green, N0ADI, and Peter Guelzow, DB2OS. This makes it possible to make visual and sound recordings of the separation during the launch. The microphone will also record



Phase 3D during checkout tests at the Phase 3D Integration Laboratory, Orlando, Florida. (Photo by Lou McFadin, W5DID)

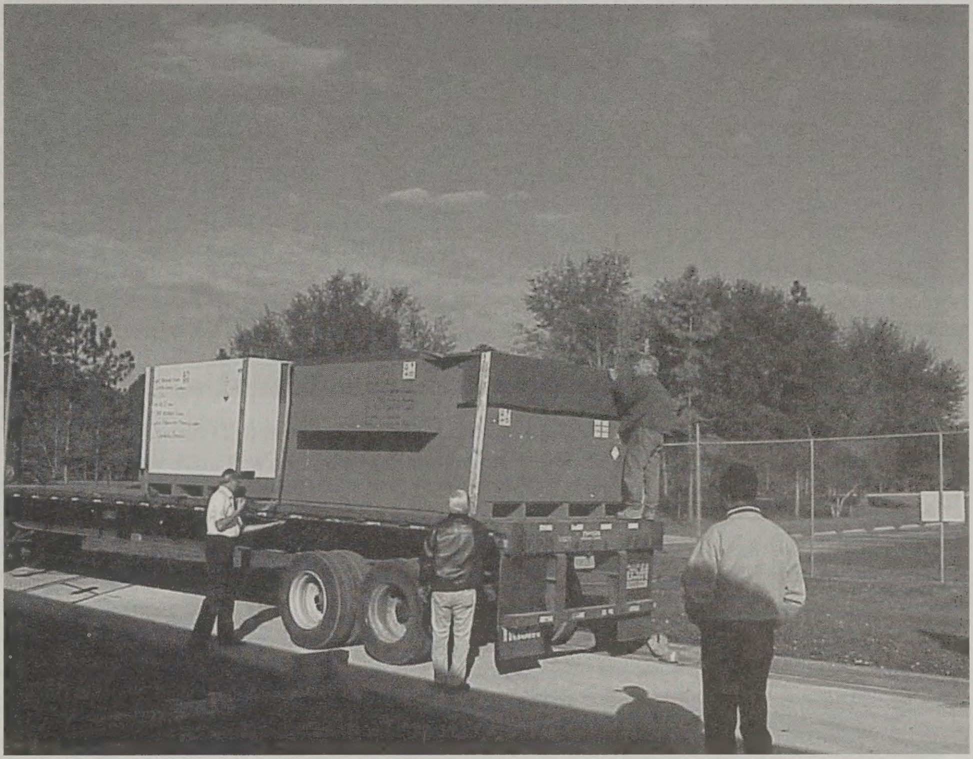
mechanical noises of the reaction wheel and other noise sources on the satellite after the take-off. To demonstrate, James Miller, G3RUH, sent a short program via e-mail, which produces an FM-downlink in the I/Q modulator using the microphone's A/D converted signal.

Naturally this is not an ordinary microphone, since in a vacuum it simply would not operate. Rather, a simple piezo element is used, which came out of an alarm sounder and was purchased at Radio Shack for a few dollars. A similar microphone was used in Washington for the thermal and vacuum tests.

The YACE camera (Yet Another Camera Experiment) should give pictures of the separation and later on it will be used for other experiments, for example, to deliver pictures of Earth and as a navigational instrument. James Miller, G3RUH, was able to obtain a license from ARM Technologies Ltd. in England for their commercial Assembler Library so Phase 3D could also be permitted to use JPEG-compression. The compression of a typical YACE picture takes 56 mS at an IHU-2 speed of 133 MHz with the help of the StrongARM processor. With a compression factor of 25 an original picture size of 256 kB will be reduced to a data size of about 15-20 kB, depending on the picture content. This means the downlink times can be dramatically improved, without too much loss of picture quality. With the IHU's large memory of 8Mb it would be possible to make a video recording of the separation, maybe even with the accompanying audio. Phase 3D will be the first (Amateur Radio) satellite that uses integrated JPEG compression software!

Stacey Mills, W4SM, of the Phase 3D Command Team, also traveled to the site for a few days to calibrate his command and telemetry decoder software with Peter Guelzow, DB2OS, and to calibrate the individual telemetry channels. A complete version of the software for Windows 95/98 with detailed specifications for the telemetry format will be made available in due course before the launch. This software will be available from the AMSAT-NA.

Another large event was the successful static load test of the support bearing structure (SBS) which was performed by Rick Leon, KA1RHL, Bob Davis, KF4FSS and Jay Ramdas. During the launch the SBS adapter carries the satellite internally with an



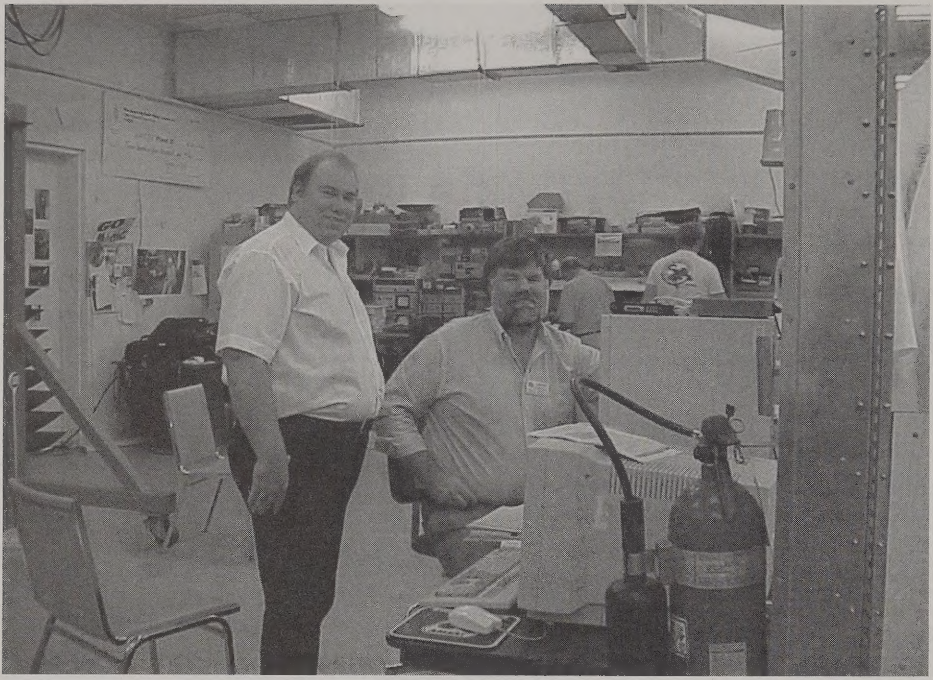
On Sunday, 16 January 2000, Phase 3D began the next phase of it's journey into space. Around 11:00 AM, EST, a truck pulled out from the Phase 3D Integration Laboratory, Orlando, Florida headed for Atlanta Hartsfield International Airport, Georgia. The handmade shipping containers contained Phase 3D, the SBS, and many tools and test equipment needed for pre-launch activities. (photo by Lou McFadin, W5DID)

AMSAT Phase 3D Flies!

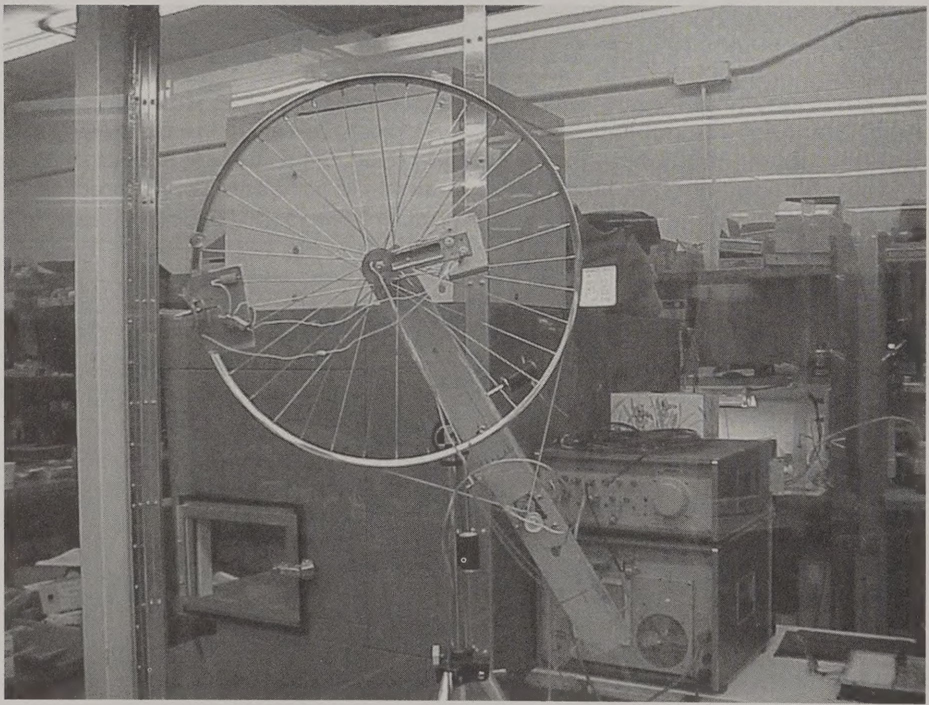
On the 17th of January 2000 AMSAT's Phase 3D will fly for the first time, however, it will be on board a 767 Air France flight from Atlanta via Paris to Kourou in French Guiana. The container with the Phase 3D satellite weighs approximately 1000 kg, the second container with the SBS-adapter and test equipment weighs approximately 1600 kg. Both containers just barely find room in the cargo hold of the 767 aircraft.

Incidentally, the transport costs alone amount to about US $20,000. First the Orlando AMSAT team will transport the containers by truck to Atlanta. Then on the 17th of January the trip continues via airplane to Paris and then to Cayenne, the only airfield in French Guiana. The trip will continue by truck to Center Spatial Guianese, the launch facility of ESA in Kourou. This is the only route that can be taken since there are no direct flights from the US to Kourou and even considering changing planes, the available airplanes would simply be too small. Phase 3D will be accompanied by Bob Davis, KF4KSS and Jay Ramdas, both from the integration team in Orlando and Peter Guelzow, DB2OS, Phase 3D operations manager, who will join them in Paris.

Phase 3D will be stored in its container in an air-conditioned integration building at the launch complex until preparations for launch commence. With all systems turned off and flight batteries uncharged, no personnel will be required on location during this period. An official start date has not been announced, but our chances for an early one are pretty good after the last successful Ariane-5 launch. AMSAT Phase 3D becomes the first secondary payload for an ARIANE 5 rocket launch. The next launch: ARIANE 505 takes place in March with two satellites; "AsiaStar and Insat 3B." 73, Peter DB2OS, AMSAT-DL.



Peter Guelzow, DB2OS (l) and Bdale Garbee, N3EAU take a break at the Phase 3D Integration Laboratory during Phase 3D checkout tests. (Photo by Lou McFadin, W5DID)



Can you guess what this equipment is and more importantly what it is used for with Phase 3D? This photo shows some special test equipment built to test Phase 3D. If you know, send your answer to Lou McFadin, W5DID (*w5did@amsat.org*). Lou says that Phase 3D Integration Team and AMSAT Officers are not eligible. We will report the winners and description in the next issue of *The AMSAT Journal*. (Photo by Lou McFadin, W5DID)

additional payload above it. It had to be tested relative to the specification of the rocket managers, which were established shortly before the test.

After the European team's departure, the team around the Integration Laboratory Manager Lou McFadin, W5DID, proceeded with some small chores and performed the so-called spin-balance test, which one can roughly compare to automobile tire balancing. In order to keep the Phase 3D rotating on its Z-axis as uniformly as possible and without wobble, appropriate weights are added. This is an important prerequisite for the path maneuvers by the 400-N propulsion engine. Following that, the Phase 3D was ready for its last major test, the vibration and shake test.

Shake Test

In the early part of August 1999, Phase 3D was transported to Washington, D.C. again on a rented truck, this time to NASA's test facility at the Goddard Space Center. Less than humorous commentators said that the truck transportation had already been an adequate vibration test. Our drivers from the Integration Team were very careful, but our greatest fear was that someone would steal the truck with Phase 3D during our overnight stay at the hotel.

The horizontal and vertical shake test at NASA again followed the specifications of our rocket management company. Prior to the test the tanks were filled with isopropyl alcohol to simulate the mass of the fuel. Naturally, the results of these tests were awaited with a great deal of expectation. Phase 3D passed this massive test very well, and the initial inspection indicated no problems or damage to the satellite. At the end of August AMSAT Phase 3D was returned to Orlando, Florida to the Integration Laboratory. Then a more complete inspection took place, and in September a further complete electrical function test on all transmitters and receivers as well as all payloads was planned. For these tests it is necessary that a European team from AMSAT-DL and their collaborators travel to Orlando once again.

Thereafter, Phase 3D will be launch-ready and should be moved to the launch site in the near future! ■

Exotic Digital Modes In Space

Peter A. Klein, KD7MW (*kd7mw@amsat.org*)

For over a year, I've had a great time on HF with two new digital modes—PSK31 and Hellschreiber. These modes allow conversational contacts under conditions where SSB or RTTY get through barely if at all. But they don't have the timing and linking requirements of AMTOR or PACTOR.

As a ham with relatively modest HF power and antennas, I use digital modes as a way to add a few "smart decibels" to my signal. Digital techniques boost a signal intelligently when it lacks brute force. I wondered, could the new HF digital modes do this for me on satellites? Based on my testing, the answer is yes. More work needs to be done to address some satellite-specific issues, but the basis is there.

Note that I'm discussing the use of digital modes on analog satellite transponders. I certainly admire what's been accomplished with the digital amateur satellites. Some cutting-edge wideband digital techniques have incredible possibilities. But my main interest is real-time communications - today. So I tried some available narrowband techniques that can be used on our narrow analog transponders.

HF and satellites are often thought of as having little in common. On the surface, that appears true. Satellites' orbits are certainly more reliable and predictable than the ionosphere, and noise at VHF and above is more "white." You don't get large Doppler shifts on HF. Achieving right-hand circular polarization with a left-handed monkey wrench is a problem unique to satellites.

But many other challenges are similar. A very weak signal is a very weak signal, and fading is fading, whether it comes from a quavering ionosphere or an antenna pattern rotating in space. I'm no purist; I'll use anything that can dig content out of a marginal signal.

New digital modes were once the province of a few diehards using dedicated hardware. But today, PSK31 and Hellschreiber software is available to every ham. Most of it is free over the Internet. It runs on a Digital Signal Processing (DSP) platform many of us already have, i.e. a Pentium or fast 486 PC with a Creative Labs-compatible sound card. Software is available for DOS and Windows, with some limited offerings for Linux and the Macintosh. There is also software for the Motorola DSP56002EVM kit, on which a lot of development took place.

By now most HF-active hams have read about PSK31, or heard its warbling signals around 14.071 MHz. PSK31 was invented by Peter Martinez, G3PLX. Operating PSK31 is much like operating RTTY. But PSK31 has many of the weak-signal advantages of CW, and may perform better than CW under some conditions. G3PLX has generously released PSK31 into the public domain for non-commercial amateur radio use.

PSK31 runs at 31.25 baud. The keying is accomplished by phase-shifting the carrier. Because often-used characters are composed of fewer binary symbols than lesser-used ones, the effective transmission speed is about 50 wpm - about as fast as most people can type. The bandwidth is an incredibly narrow 31 Hz.

PSK31 has two modulation modes. The more commonly used BPSK uses 180° phase shifts, is slightly more sensitive, and has no error correction. QPSK uses 90° shifts and a Viterbi decoder for error correction.

The tuning accuracy requirements are pretty stiff: ±7 Hz for BPSK, and ±3 Hz for QPSK. Since most radios tune in 10 Hz or greater increments, the software allows finer adjustments via the arrow keys, or by clicking the mouse on a visual signal display. The software also implements audio AFC, which can automatically fine-tune a signal and follow it if it drifts slightly.

PSK31 is extremely sensitive. A little power goes a long way, making it a good mode for a satellite transponder. The first time I saw just *how* sensitive PSK31 is, I could barely believe it. I was listening to an S-3 signal on twenty meters, and switched my antenna tuner to its dummy load position. The tone almost disappeared into my receiver's noise floor, but the software kept right on decoding perfectly, as if nothing had happened.

The weakness of the signal reminded me of AO-10's deep QSB. Hmm, I thought. How might PSK31 fare on AO-10?

AO-10 presents many challenges. Its computer and batteries failed long ago, leaving only the power from the solar panels. We can't control its attitude. AO-10 goes to "sleep" for weeks at a time, with periods of bad transponder FMing before and after the sleep periods. Then it will work nicely for a while, but with deep QSB as the satellite slowly tumbles.

During April 1999, AO-10 was working well. On April 23, I decided to send PSK31 into space. I ran a text file through the PSK31 program off the air, and recorded the sound card output on an ordinary cassette tape recorder. Then I transmitted the recording to AO-10 while receiving the downlink.

AO-10's Doppler shift is only about 5 Hz/minute or less for all but the near-perigee portion of its orbit. PSK31's AFC can track

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The basic idea of P is that keying is doie bykha
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carrier rather than frequency-shifting it. The bandwidth is equal to the
baudrate rather than to the shift plus the baudrate. With tme chosen
baudrate of 31.25, that brings the bandw th dow   ftop ) aiq0Hz of
other modes down to 31Hz. By using an alphabet similar to morse with
short codes for common letters, the text speed of PSK3f comes oÁ at
about 50 wpm.

By using the narrowest possible filters in the transmitter aad receiver,
the performance of PSK31, even without error-correction, is certainly
better than most, and has the added advantage for live QSOs that the
performance degrades very gracefully as the signal drops.

This is KD7MW, Peter in Seattle, Washington, testing PSK31 on OSCAR 10.
This text/ame;rom the PSK31 Help fi|, “PSK31 Overview.”
En t of test.
```

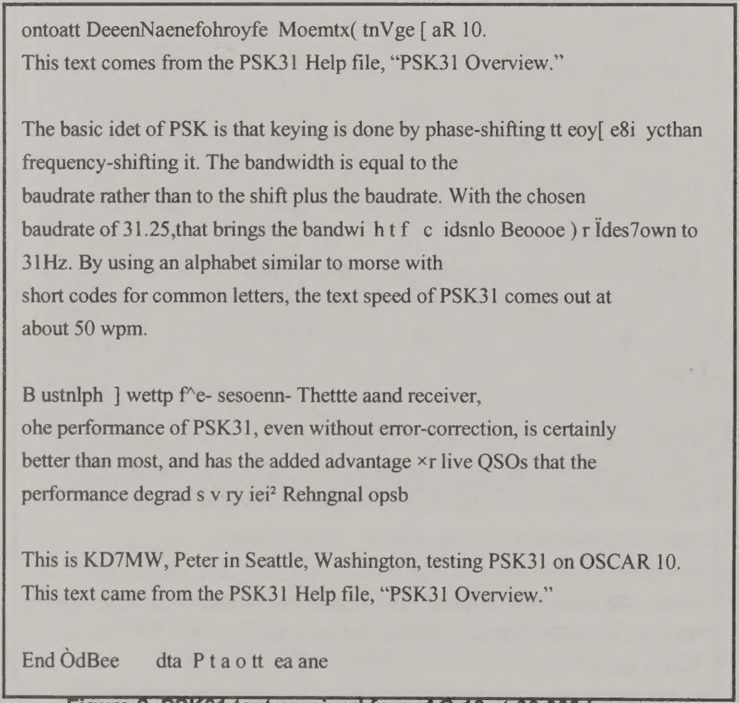
Figure 1. PSK31 text received from AO-10 at 26,000 km. range.

such a slow drift. But the frequency of the transponder itself varied about ±25 Hz during a two minute transmission. I believe this was caused by a combination of transponder loading from high-powered operators, and variation of sunlight on the satellite's solar panels.

A frequency variation this small is no problem on SSB or CW. But it was too much for PSK31. Using QSPK and its error correction was impossible. But after a bit of practice using BPSK, I was able to manually compensate for the frequency variation.

The PSK31 software has a fine-tuning indicator called a *phase circle* that looks like a clock. When a signal is correctly tuned, the clock's "hands" form a vertical yellow bar. As the signal moves off frequency, this bar rotates. I had to keep the bar vertical, using the left and right arrow keys to adjust the frequency in 1 Hz increments. It was like driving a Volkswagen Beetle in a gusty crosswind, but it worked. When the frequency shifted during a deep fade, I could still copy if I estimated the amount of drift correctly.

You can see the results of my first test in Figure 1 which is copy with the satellite at about 26,000 km from my station. I was running about 30 watts output. As you can see, copy is very good. Most of the errors were the result of transponder frequency shifts that I couldn't follow manually. If the program's AFC could have followed the frequency variations, I suspect copy would have been nearly perfect.



```
ontoatt DeeenNaenefohroyfe  Moemtx( tnVge [ aR 10.
This text comes from the PSK31 Help file, "PSK31 Overview."

The basic idet of PSK is that keying is done by phase-shifting tt eoy[ e8i  ycthan
frequency-shifting it. The bandwidth is equal to the
baudrate rather than to the shift plus the baudrate. With the chosen
baudrate of 31.25,that brings the bandwi  h t f   c  idsnlo Beoooe ) r Ïdes7own to
31Hz. By using an alphabet similar to morse with
short codes for common letters, the text speed of PSK31 comes out at
about 50 wpm.

B ustnlph  ] wettp f^e- sesoenn- Thettte aand receiver,
ohe performance of PSK31, even without error-correction, is certainly
better than most, and has the added advantage ×r live QSOs that the
performance degrad s v ry iei² Rehngnal opsb

This is KD7MW, Peter in Seattle, Washington, testing PSK31 on OSCAR 10.
This text came from the PSK31 Help file, "PSK31 Overview."

End ÒdBee      dta  P t a o tt  ea ane
```

Figure 2. PSK31 text received from AO-10 at 36,000 km. range.

The second example (Figure 2) shows the satellite near apogee, about 36,000 km away. I was running about 65 watts. Copy is somewhat degraded, but still usable. At this signal level, I might have attempted a slow, "callsign and report" CW contact, but certainly not conversation.

Note that my setup is not an Oscar superstation. It consists of a Yaesu FT-736R, 100-watt TE amplifiers with preamps, and a 2-meter DCI helical filter. The antennas are 14 and 30-element circularly polarized M^2 beams on 2 meters and 70 cm respectively, through about 40 feet of 9913 coax and 10 feet of RG-8. People with those 20-foot long 2-meter beams can hear AO-10 much better than I can. Using PSK31 seemed almost like doubling my boom length.

The next step was to have a PSK31 contact with another satellite operator. I put a query on AMSAT-BB, an AMSAT mailing list on the Internet. Frank Sperber, DL6DBN, of Siegen, Germany responded. I didn't know it then, but Frank is the editor of the *AMSAT-DL Journal*. We arranged to make contact at 2100 UTC on 26 April 1999.

We had to work hard for that contact. Frank had fairly good copy on me, especially near the end of the contact. On my end, conditions were much noisier during my initial tests, and Frank was running lower E.R.P. than I was. I copied our callsigns, my signal report and a few words here and there. Still, we made what was probably the first transatlantic PSK31 contact on an amateur satellite, if not the first satellite PSK31 contact ever.

Having successfully used PSK31, I decided to attack AO-10's transponder instability with another mode - Hellschreiber. The name means *bright writing* in German, and is affectionately shortened to just plain *Hell* by its devotees.
Hellschreiber is new to most hams, but it's actually a very old mode invented in 1929 by Dr. Rudolph Hell.

Hell has some very special properties. It's a *fuzzy* mode that is sent and received by machine, but decoded with the pattern-matching abilities of the human eye and brain.

In this article, I will deal with only the simplest method of sending Hell, known as "Feld-Hell." It uses on-off keying, and sounds much like bursts of dits in very fast CW.

Hell is a kind of facsimile. It uses a special font resembling the output of a dot matrix printer. Each letter is broken up into a stream of dots. The transmitter keys the carrier on for a black dot and off for white. There is no synchronization to tell the receiver when each column of dots begins. So each letter is printed twice, one above the other. This guarantees that one of the letters is not cut in half.

The original mechanical Hellschreiber systems printed on paper tape. Current software displays *virtual* paper tape on the computer screen. The most full-featured Hell software by Nino Porcino, IZ8BLY, adds some modern refinements. It displays the dots in shades of grey based on signal strength, and adds raised-cosine shaping to the keying. The shaping lowers the bandwidth to about 245 Hz. Transmission speed is about 25 words per minute. Feld-Hell has a low duty cycle (about 21%), making it a very low-impact mode on a satellite transponder.

One very nice thing about Hell is that you can often read a character containing several badly-received pixels, especially with grey-scale implementations. This is unlike RTTY or even BPSK-PSK31, where even one bit error means an incorrect character. Hell also gives a beautiful visual indication of what is happening to the received signal.

Feld-Hell is not as sensitive as PSK31, so it doesn't work as far out into AO-10's orbit, or as deeply into the worst QSB. But it isn't nearly as frequency-sensitive as PSK31. So it can be used on AO-10 with occasional, rather than constant tuning.

I tested Feld-Hell on AO-10 on May 14, 1999, using the same method I had used for my PSK31 tests. Copy was excellent out to 17,000 km range with only 35 watts output (Figure 3). Copy was still quite good out to 27,000 km with 90 watts (Figure 4).

At 33,000 km range, cyclical QSB was terrible, with the signal disappearing into the noise for several seconds at a time. The IZ8BLY software can slow the Feld-Hell signal to 1/4 or 1/8 of normal speed. This mimics the CW operator's weak-signal trick of sending slow code and receiving with very narrow filtering. 1/8 speed is about one character every 3 seconds. Though excruciatingly slow, 1/8 speed provided usable copy through the fades (Figure 5).

At 37,700 km range, the QSB put big holes in the copy even at the slowest speed (Figure 6).

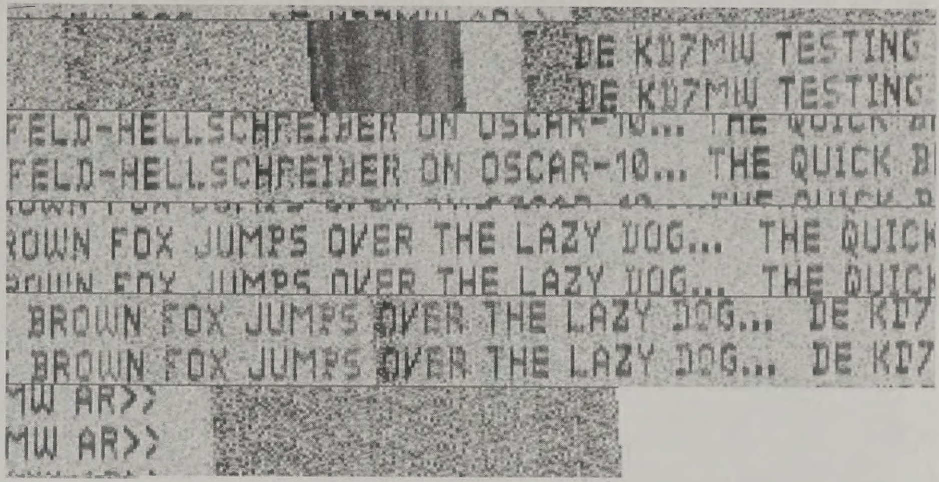
What can we conclude from all this? My tests show that something based on PSK31 has a great future in space. There is another precedent. PSK at 400 bps has been used on amateur satellites for years, both on digital birds and for Phase III telemetry and command. Peter Guelzow, DB2OS has told me that he and Randy Smith, VE1SAT/VE6 used 400 bps PSK for several two-way AX.25 contacts on OSCAR 10 back in 1985.

Here is a modest proposal for all you talented AMSAT programmers. Use G3PLX's public domain PSK31 code as the basis for a satellite-optimized PSK keyboard-chat mode, which I'll call SAT-PSK.

Two major things need to be done First, the trade-off between data rate, bandwidth and tolerance for off-tuning needs to be tailored for satellite conditions. SAT-PSK might even have two rates. There could be a fast, wider bandwidth rate for LEO satellites and good conditions on a Molniya-orbit bird, and a slower low gear for very weak signal conditions, such as AO-10 at apogee or people with less than optimum antennas.

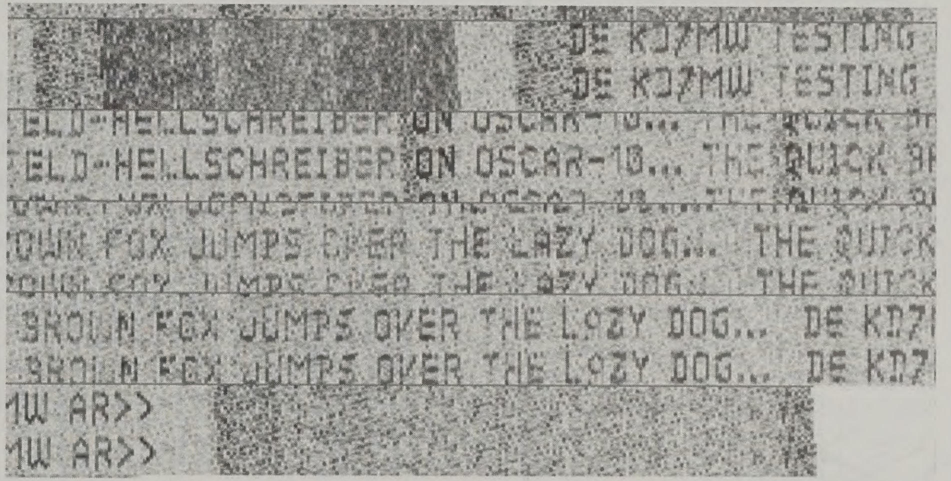
Second, PSK31 needs automatic frequency control that can handle Doppler shift. Right now, it takes a couple of determined operators to wrest a PSK31 contact out of AO-10. Using PSK31 on LEO satellites seems out of the question. But if someone were to add some really robust frequency control, we might have something!

PSK31's current AFC might suffice for Mode U/V (old Mode B) during most of the orbit of Phase 3D. But suppose SAT-PSK could lock onto a PSK signal and follow it throughout the receiver's audio passband? Better yet, suppose it could also tune the radio to keep the PSK tone within the passband, similar to the way digital satellite



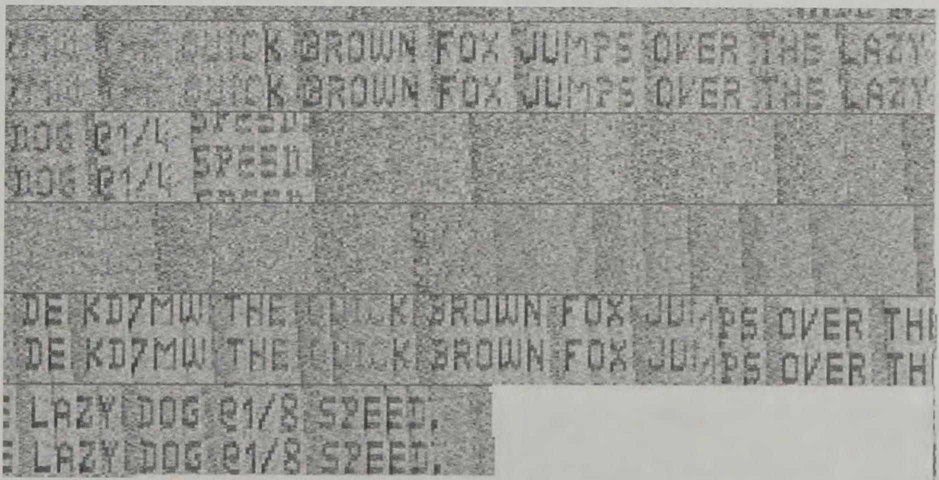
```
DE KD7MW TESTING
DE KD7MW TESTING
FELD-HELLSCHREIBER ON OSCAR-10... THE QUICK B
FELD-HELLSCHREIBER ON OSCAR-10... THE QUICK B
ROWN FOX JUMPS OVER THE LAZY DOG... THE QUICK
ROWN FOX JUMPS OVER THE LAZY DOG... THE QUICK
 BROWN FOX JUMPS OVER THE LAZY DOG... DE KD7
 BROWN FOX JUMPS OVER THE LAZY DOG... DE KD7
MW AR>>
MW AR>>
```

Figure 3. Hellschreiber via AO-10 at 17,000 km range.



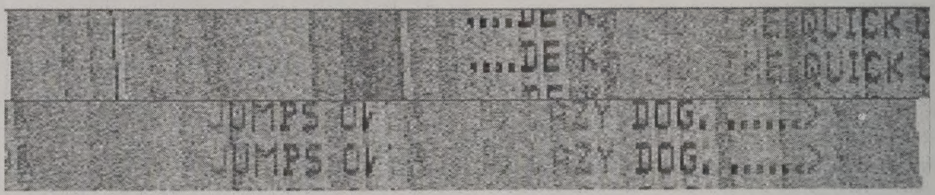
```
DE KD7MW TESTING
DE KD7MW TESTING
FELD-HELLSCHREIBER ON OSCAR-10... THE QUICK B
FELD-HELLSCHREIBER ON OSCAR-10... THE QUICK B
ROWN FOX JUMPS OVER THE LAZY DOG... THE QUICK
ROWN FOX JUMPS OVER THE LAZY DOG... THE QUICK
 BROWN FOX JUMPS OVER THE LAZY DOG... DE KD7
 BROWN FOX JUMPS OVER THE LAZY DOG... DE KD7
MW AR>>
MW AR>>
```

Figure 4. Hellschreiber via AO-10 at 27,000 km range.



```
QUICK BROWN FOX JUMPS OVER THE LAZY
QUICK BROWN FOX JUMPS OVER THE LAZY
DOG @1/4 SPEED
DOG @1/4 SPEED
DE KD7MW THE QUICK BROWN FOX JUMPS OVER TH
DE KD7MW THE QUICK BROWN FOX JUMPS OVER TH
 LAZY DOG @1/8 SPEED.
 LAZY DOG @1/8 SPEED.
```

Figure 5. Hellschreiber 1/8 speed via AO-10 at 33,000 km range with QSB.



```
....DE K         E QUICK
....DE K         E QUICK
  JUMPS OV        AZY DOG. ......>
  JUMPS OV        AZY DOG. ......>
```

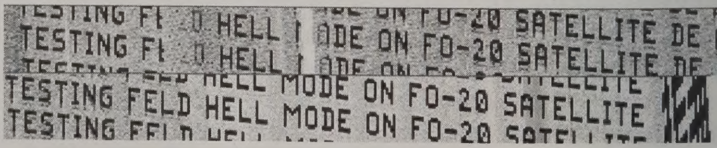
Figure 6. Hellschreiber 1/8 speed via AO-10 at 37,700 km range with QSB.

modems use microphone up/down control lines to keep a signal centered? This would give us the ability to use SAT-PSK on LEO satellites, and probably on Phase 3D's Mode L/S.

Meanwhile, in the here and now, Feld-Hell performance is similar to ordinary CW at medium AO-10 ranges. Hell also has possibilities on LEO satellites. In December, 1999, Tony Bombardiere, AB2CJ transmitted a tape-recorded Hell signal to FO-20. He found it relatively easy to follow his signal despite the fast Doppler shift on the 70 cm downlink. The graphic clip Tony emailed me shows excellent copy, with a bit of a slant caused by Doppler shift and tuning errors (Figure 7).

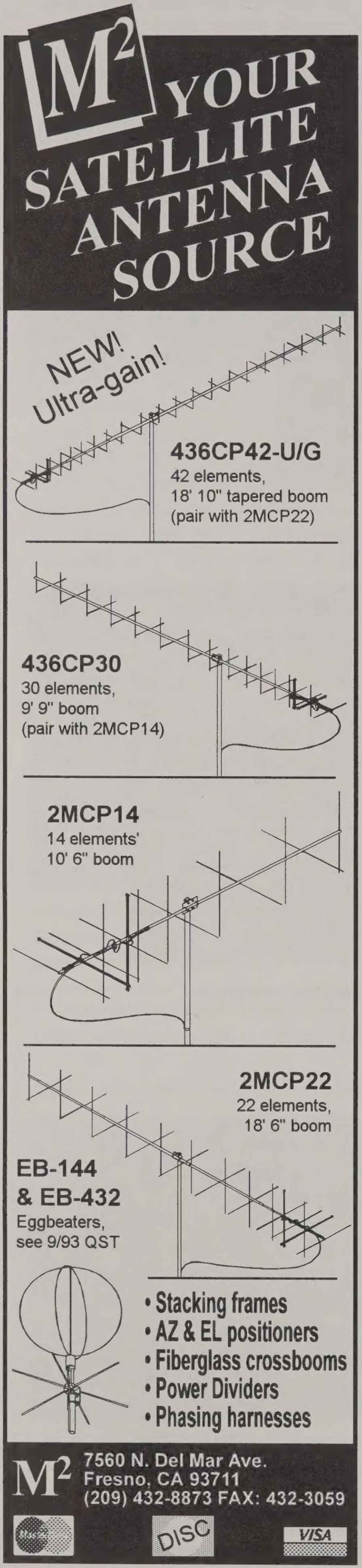
For further information on PSK31, go to the *Official* PSK31 Web Site at *http://aintel.bi.ehu.es/psk31.html*. A mirror site that is often faster in North America is *http://www.kender.es/~edu/psk31.html*. You can download the G3PLX software at these sites, or link to sites with additional information and other PSK software. You can find printed information about PSK31 in the May 1999 *QST* and the July/August 1999 *QEX*. The new *ARRL's HF Digital Handbook* by Steve Ford, WB8IMY discusses both PSK31 and Hellschreiber.

Further information on Hellschreiber can be found at *http://www.qsl.net/zl1bpu/*. You can get most available Hellschreiber software there. The IZ8BLY software really needs a Pentium PC for satisfactory performance. IZ8BLY's home page is *http://www.freeweb.org/varie/ninopo/radio/Hell/index.htm*. Just before this issue went to press, an informative article about Hellschreiber by Murray Greenman, ZL1BPU appeared in the January 2000 issue of QST, pages 52-54.■



```
TESTING FE  D HELL MODE ON FO-20 SATELLITE DE AI
TESTING FE  D HELL MODE ON FO-20 SATELLITE DE AI
TESTING FELD HELL MODE ON FO-20 SATELLITE
TESTING FELD HELL MODE ON FO-20 SATELLITE
```

Figure 7. Hellschreiber via FO-20 showing effects of Doppler and tuning errors.



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DISC VISA

RS-13 and the Latitude 40N DX Anomaly

John Branegan, GM4IHJ (*gm4ihj@branegan.demon.co.uk*)

Back in the 1970s, American and Canadian 6 meter DX operators discovered that when direct great circle paths to Europe were closed, there was often a possible indirect propagation path via back scatter. Aiming one's antenna at the Caribbean or West Africa could provide European contacts at times, provided that the Europeans were also aiming at this indirect scatterer. Ionospheric profiles taken by UO-11 in 1987 showed an electron density peak near overhead Latitude 40N. Now in 1999, RS-13 is revealing much clearer evidence for this phenomenon.

For some weeks in October 1999, RS-13 has been tracking North to South down over Africa and the Atlantic producing signals from its 29.458 MHz beacon which, when examined on a computer using Fast Fourier Transform Digital Signal Processing (FFTDSP), show clear evidence of an ionospheric anomaly near latitude 40N.

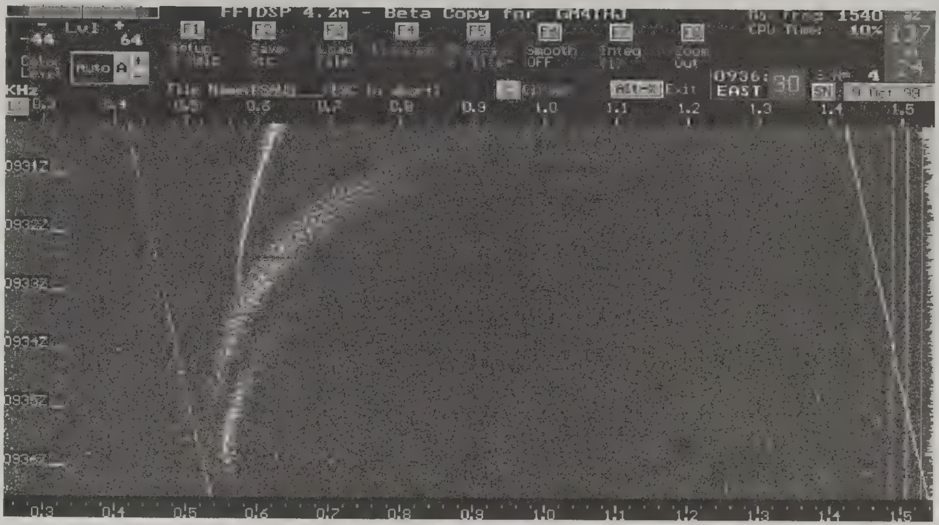

Figure 1. RS-13 Pass Over East Africa: 0931 to 0936 UTC, 09OCT99.

Figures 1 - 3 are FFT charts of received audio from RS-13 in the band 0.3 to 1.5 kHz. Software used was developed by AF9Y. In the first illustration there is a record from 0931 UTC to 0936 UTC taken on 09OCT99. Time is recorded down the left side, signal strength is indicated on the right hand side, and the signal itself first appears as a clear thin trace Doppler shift slightly lower from a start at 0.62 kHz audio as it goes down the figure. Later signals produced by the anomaly are not tone 9, so they appear much wider and more diffuse being about tone 2 or 3.

RS-13 Pass Over East Africa: 0931 to 0936UTC 09OCT99

UTC	Az	EL	Lat N	Long W	Overhead
0931	117	4	39	333	Turkey
0933	124	-2	32	332	Egypt
0935	130	-8	25	332	Egypt
0937	134	-13	18	331	Sudan

Commentary on 0931 UTC Pass

A strong T9 signal track is evident at 0.62 kHz, while the satellite is above the Scottish southern horizon until 0933 UTC when this clear signal fades. But already at 0931 a broad T2 signal much less Doppler negative (circa 200Hz) is evident clearly via a different indirect signal path from the satellite. This signal then gradually develops a more negative Doppler until it matches that at which the clear direct signal faded, then the broad tone continues until 0935 UTC. Meanwhile at 0934 UTC a second broad tone signal has Doppler shift in from about 100 Hz high. It continues until 0936 UTC.

RS-13 Pass Over West Africa: 1115 to 1123 UTC 09OCT99

UTC	Az	El	Lat N	Long W	Overhead
1115	170	23	42	0	Spain
1117	170	10	35	359	Algeria
1119	170	2	28	358	Algeria
1121	172	-5	21	358	Sahara
1123	171	-11	14	357	Niger

Commentary on 1115 UTC Pass

This orbit followed the one shown on Figure 1 but tracked much further to the west. The direct above the horizon signal from RS13 started at 0.66 kHz and was present until 1119 UTC with clear tone 9 throughout. A broad rough signal begun to intrude 460 Hz higher at 1116 UTC. This then Doppler shifted down to meet the frequency at which the clear tone signal disappeared, continuing on there after to fade at 1123 UTC.

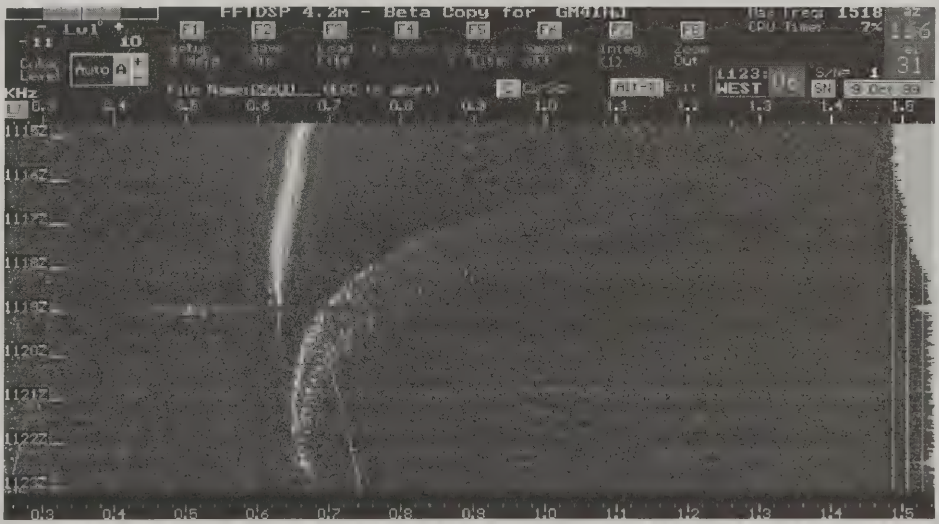

Figure 2. RS-13 Pass Over West Africa: 1115 to 1123 UTC 09OCT99.

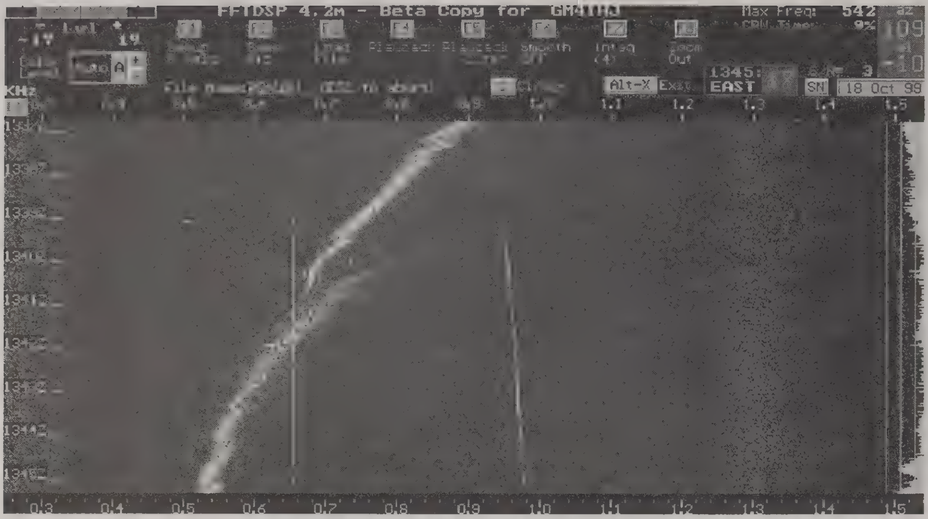

Figure 3. RS-13 Pass Down the Western Atlantic Ocean: 1337 to 1345 UTC on 18OCT99.

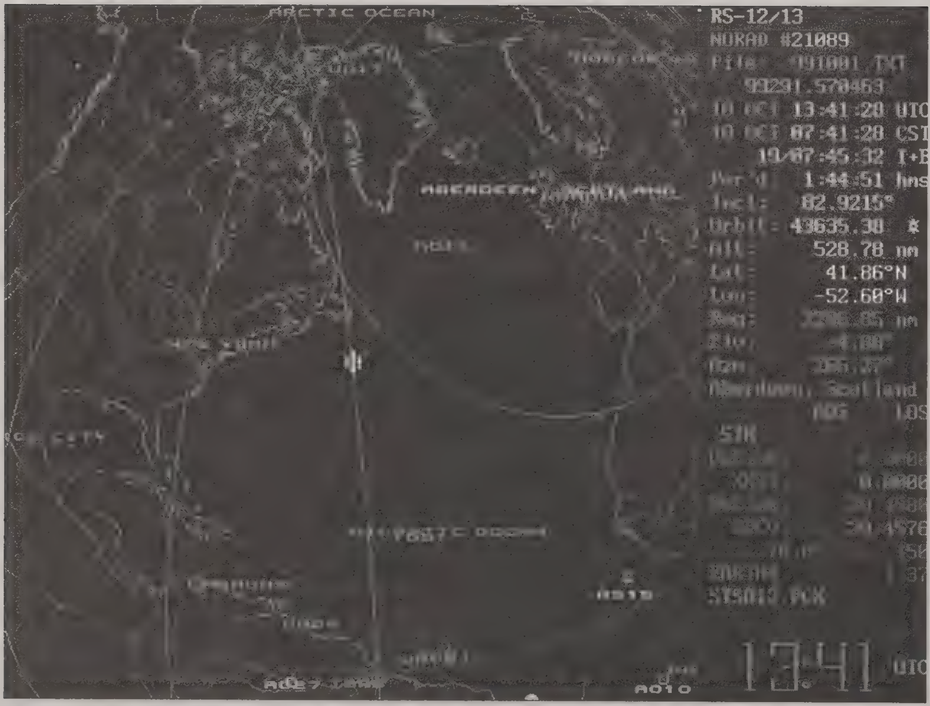

Figure 4. A orthographic view by *STSPlus* of RS-13 at 1337 UTC, 18 October 1999.

RS-13 Pass Down the Western Atlantic Ocean: 1337 to 1345 UTC on 18OCT99

UTC	Az	EL	Lat N	Long W	Overhead
1337	294	1	57	56	East of Labrador
1339	280	-1	50	54	East of Newfoundland
1341	269	-4	43	52	East of New Hampshire
1343	259	-7	36	51	East of the Carolinas
1345	252	-11	29	51	East of Florida

Commentary on 1337 UTC Pass

This track was followed as it passed far to the west of Scotland, always near or below the horizon (Figure 4). The record commences with RS13 on the GM horizon at 1337 UTC when the signal is already a broad rough tone 3. It continues until 1341 UTC, showing the typical uneven zigzag Doppler track often seen from sub horizon signals of 29 MHz beacons. At 1340 a second signal comes with a Doppler shift of a frequency 160 Hz higher, and it continues as a rough tone 1 signal until 1347 UTC off the record, before fading. Please note the large variations in signal amplitude revealed by the record at the right hand side of the display.

Summary of Results

The records show at commencement a relatively clear tone signal coming as expected off the stern of the satellite as it heads south away from the listening station. This signal coming in a direction at a very large angle with respect to the satellites direction of motion exhibits as expected a marked Doppler shift low to about 600 Hz below the actual beacon frequency.

The satellite then passes alongside the ionospheric anomaly and a second signal path is generated whereby a signal coming off the satellite at a modest angle to its direction of motion say 90 to 100 degrees rather than the 180 degrees of the clear signal, i.e. with much less Doppler shift low, illuminating the anomaly which then scatter the signal back to Scotland.

Then as the satellite continues south it leaves the anomaly further to its rear, illuminating it with a signal adopting a progressively larger angle with respect to the satellites direction of motion, a signal with Doppler getting much more negative. So that eventually this second broader rougher signal coming via the anomaly is originating from the stern of the satellite and therefore acquires a Doppler shifted frequency similar to that of the clear tone original lost near the station horizon. Thereafter this signal persists until the anomaly drops below the satellite's horizon.

In some but not all events noted in Scotland this October there is evidence of a split in the anomaly or a second anomaly located south of the first anomaly.

Conclusions

There appears to be a strong possibility that the anomaly seen by RS-13 is the same as the one that produces the non-great circle 6 meter DX paths from W and VE into Europe.

This evidence reveals an anomaly stretching across more than 80 degrees of longitude located somewhere near latitude 40N (Figure 5). Is it possible that it actually circles the globe? Does it have a counterpart in the Southern Hemisphere? These are questions that can be answered by future investigations of Amateur Radio satellites.■

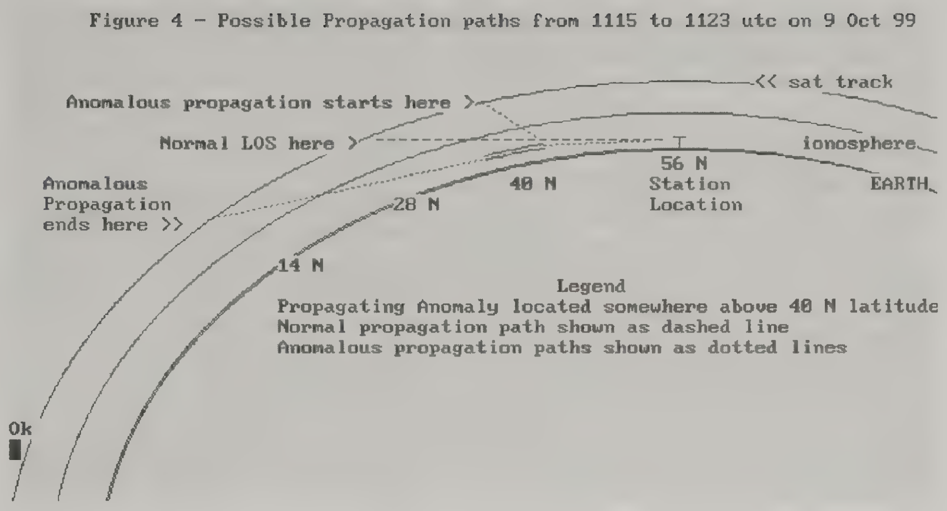
Figure 4 - Possible Propagation paths from 1115 to 1123 utc on 9 Oct 99
<< sat track
Anomalous propagation starts here >
Normal LOS here >
ionosphere
56 N
Station
Location
EARTH
40 N
Anomalous
Propagation
ends here >>
28 N
14 N
Legend
Propagating Anomaly located somewhere above 40 N latitude
Normal propagation path shown as dashed line
Anomalous propagation paths shown as dotted lines
0k

Figure 5. Graphic description of the Latitude 40N anomaly.

Satellite Orbital Elements

By Ray Hoad, WA5QGD

Satellite	AO-10	FO-20	RS-12/13	RS-15	FO-29	AO-27	UO-11	MIR
Catalog Number	14129	20480	21089	23439	24278	22825	14781	16609
Epoch Time	00012.14359188	00012.98556374	00013.18992701	00013.13338177	00013.20050946	00013.14019103	00012.9404317	00013.85653757
Element Set	617	214	214	450	308	794	227	249
Inclination	27.1196	99.0292	82.9234	64.8179	98.5856	98.4332	97.9599	51.6544
RA of Node	351.0588	172.8183	301.4747	72.8808	301.5143	75.8171	339.1648	338.5818
Eccentricity	0.6016894	0.0541265	0.0028134	0.0164526	0.0350491	0.000995	0.0010231	0.0004158
Arg of Perigee	18.6452	49.0929	197.591	315.9701	270.5734	4.072	238.6149	244.6618
Mean Anomaly	356.1868	315.5763	162.4277	42.8222	85.5268	356.0544	121.4065	115.3933
Mean Motion	2.05870365	12.83261423	13.74164367	11.27534379	13.52696677	14.28014447	14.71210814	15.86632753
Decay Rate	-0.00000105	-0.00000043	0.0000002	-0.00000032	0.00000003	0.00000181	0.0000144	0.00103397
Epoch Rev	12469	46524	44825	20791	16820	32820	84932	79464
Satellite	AO-16	DO-17	WO-18	LO-19	UO-22	KO-23	KO-25	ISS
Catalog Number	20439	20440	20441	20442	21575	22077	22828	25544
Epoch Time	00013.71016826	00013.17735347	00013.20376198	00013.15994318	00013.66161459	00012.96653951	00013.18121507	00013.87228009
Element Set	286	290	324	300	0	896	761	251
Inclination	98.4657	98.4745	98.4735	98.4792	98.172	66.0813	98.4305	51.5883
RA of Node	91.5536	92.8032	92.561	93.9042	49.0112	337.4805	76.5646	212.7939
Eccentricity	0.0011692	0.0011451	0.0012032	0.0012319	0.0007564	0.0000081	0.0011106	0.0007449
Arg of Perigee	324.0183	323.9789	323.8905	323.2761	316.5641	259.3198	347.6769	76.095
Mean Anomaly	36.0228	36.0628	36.1466	36.7581	43.495	100.7804	12.4136	115.8111
Mean Motion	14.30345541	14.30514185	14.30446653	14.30580069	14.37499278	12.86333428	14.28529268	15.64329046
Decay Rate	0.00000239	0.00000273	0.00000202	0.00000243	0.00000289	-0.00000037	0.00000236	0.0003466
Epoch Rev	52066	52063	52063	52066	44557	34862	29639	6553
Satellite	IO-26	TO-31	GO-32	SO-33	PO-34	SO-35	UO-36	Phase 3D (est)
Catalog Number	22826	25396	25397	25509	25520	25636	25693	999934
Epoch Time	00013.17187855	00013.17743771	00013.15475931	00013.2232516	00013.56427556	00013.15197406	00013.09511689	96260.25520000
Element Set	789	250	253	144	134	174	153	3
Inclination	98.4345	98.7356	98.7366	31.4426	28.4619	96.4733	64.56	60.0203
RA of Node	76.4023	90.1596	89.9852	52.1845	148.5018	255.2337	225.6346	342.7876
Eccentricity	0.0010323	0.0004347	0.0001353	0.036688	0.0007088	0.0152602	0.0032366	0.6752895
Arg of Perigee	4.9165	155.6156	141.4994	159.5059	42.4916	313.5132	319.2864	180.1221
Mean Anomaly	355.2115	204.5283	218.6298	202.0709	317.6244	45.3463	40.5808	179.5059
Mean Motion	14.28146997	14.2251108	14.22322966	14.24315578	15.04667025	14.41080857	14.73544423	1.51063698
Decay Rate	0.00000194	-0.00000044	-0.00000044	0.00000377	0.00002323	0.00000485	0.0000033	0.0002
Epoch Rev	32823	7847	7848	6357	6641	4661	3930	2

That Darn Drake

Gerald (Jerry) R. Brown, K5OE (*k5oe@amsat.org*)

Still have that Drake 2880 you bought last year sitting on the shelf, unmodified? Here is a step by step guide of how to get it done and be one step closer on mode S for Phase 3D.

The first thing you will need is a computer with Internet access. You should visit at least two of the many sites that detail the modifications to this downconverter. This discussion is limited to the excellent data (and pictures) presented in two of those sites. If you have a color printer, go ahead and print out the pages for future reference. The first site is one of the original postings by Masa Arai, JN1GKZ: *http://www.din.or.jp/~m-arai/sband/convmode.htm*

The second site is a further discussion of various mods by David Bowman, G0MRF: *http://www.qsl.net/g3pho/drake.htm*

The second thing you will need is the right toolbox. You will need a very good, small Phillips-head screwdriver: the screws are very soft and easy to strip. You will need a magnifying glass (yes you will), a set of small needle nose pliers, solder wick, very small diameter solder, and a small soldering iron. Also useful would be a Pana-Vise and a pair of tweezers.

Ready!

Now that you have researched the on-line material, it is time for a little soul-searching. How much experience and/or skill do you have with *very small* electronics? I don't want to unnecessarily worry you, but this Drake 2880 is definitely not your father's Heathkit. Let me offer several options, based on my own experiences, before we go any further, and you can decide where you feel comfortable.

Level 1: Are You Crazy? The unit will work just fine with an IF of 120 MHz, but with very low gain, about 12 dB, and a noise figure of about 10 dB. If you 1) use a receiver capable of 120 MHz SSB, 2) have a high gain antenna, such as the popular Myers/Conifer 24 dB *barbecue grill* dish, and 3) can provide 12 Vdc up the coax, then you can leave the screws on the cover and stop reading here. From what we know today, Phase 3D mode-S is still within your grasp.

Level 2: OK I'll Do The Easy Stuff. Take the screws out of the cover, take the screws out of the interior shield, and remove the two red coils and the two chip capacitors as shown in the JN1GKZ article. The chip caps provide you a chance to practice your surgery skill with a magnifying glass and tweezers. You now have a unit with 15.5 dB of gain and a NF of 7.8 dB.

Level 3: That Was Easy, What's Next? Now it is time to replace the crystal and move the IF down into the 2 meter ham band. Carefully de-solder both the N-connector and the F-connector. The N-connector has a holding nut, but the F-connector screws out and solder wick is recommended. Be very careful of the latter as it is easy to damage the center pin. Next, remove the remaining screws on the circuit board, including the two on the voltage regulators and the small one in the middle by the vertical shield. Remove the circuit board and carefully de-solder and remove the old crystal. You will likely have to de-solder and suck out the holes (solder sucker bulb is very handy) before the replacement crystal will insert. Make sure the crystal is flush and cut the leads off very short after soldering. You now have downconverter that puts the IF at 144 MHz for 2400 MHz input. You, of course, could pick another IF, like 140 MHz (my preference for easy mental conversion to 2400) or even somewhere in the 70 cm band. A 70 cm IF would be convenient if you plan to use 2 meters for uplink or to drive an L-band converter and the JN1GKZ site has the information for that modification. I personally think the 2 meter IF is preferable, allowing mode U/S with a common dual-band rig (FT-847, IC-821H, *etc.*) and modest antennas. I anticipate modes V/U and U/V to give way to modes U/S and L/S very quickly.

Level 4: Tweak That Baby. G0MRF has two modifications that will bring you up to about 22 dB of gain and a 5.5 – 6.0 NF: adding a pair of 22 pF capacitors to the IF stage and physically extending the image stripline filter. You can find suitable 22 pF ceramic disc capacitors at Radio Shack 272-806 (all I could find on Sunday afternoon). Cut the capacitor leads short, about 4 mm, and bend them halfway at 90 degrees to facilitate soldering in place (you will want the magnifying glass for this operation). For the stripline filter, cut a couple of capacitor or resistor leads to about 3 mm and solder to the ends of the board striplines, extending them about 1.5 mm. Note the two striplines are not the same length. Compare your final *extensions* to the one in the fine picture on the G0MRF site noted above. This is a far as I was willing to go, but all went well and the patient survived. I am indebted to the above referenced authors for making their knowledge and experience available.

Level 5: Oh, I Forgot Power. The Drake unit will accept 12 Vdc up the coax (into the F-connector). If your rig has that capability or you are inclined to add it externally, that is the easy way to go. The JN1GKZ site has a simple mod for routing external power up to the unit, but it requires drilling a hole in

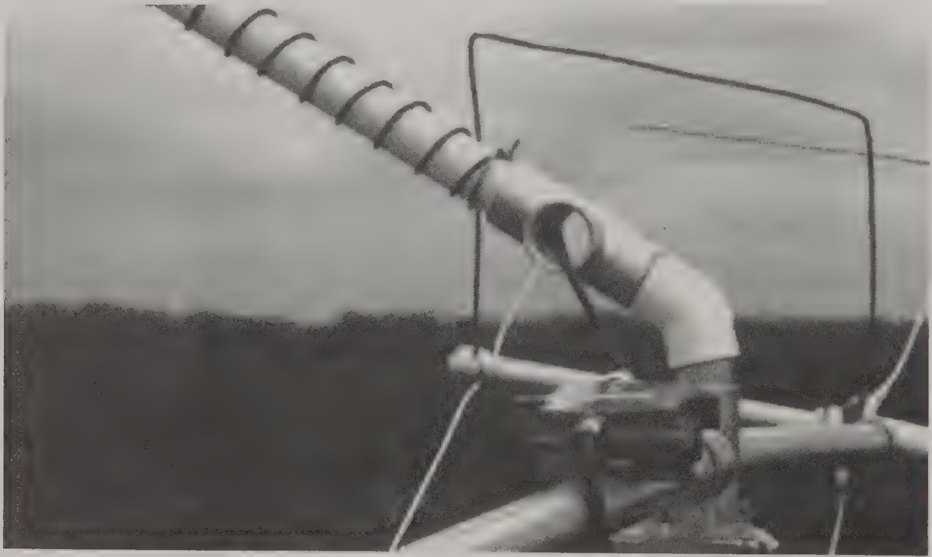

Figure 1. The Converted Drake 2880 Set Up For OSCAR-11 Reception.

the case. I cringe at the thought of drilling a hole in an obviously well-made weatherproof enclosure, so I opted to bypass this mod and power the unit from my rig (IC-820H).

Level 6: Where Only The Brave Follow. G0MRF has the ultimate modification, replacing the stock Drake GaAsFET with a higher performance device, an MGA88578. This mod requires extensive revision to the RF amplifier section of the board, but results in an impressive 32 dB of gain at almost 2 dB NF. Now you are talking real low-noise performance. The JN1GKZ site also has a RF amplifier mod, but it appears to offer less for the effort. For my money, a low noise MMDS preamp (California Amplifier model no. 30947, $60 plus shipping) may be a safer bet to get to these kinds of performance levels.

Set!

As I noted above, I took my unit up to Level 4 (and stopped). The next step is to calibrate the IF for the desired frequency. There is a (very small) variable capacitor on the board that can be adjusted to set the IF frequency right on the mark. Be sure and use a non-metallic screwdriver (or wide toothpick) to adjust the frequency. I made up a signal generator using a high power switching diode, 1N4005, and five 47 K ½ Watt resistors. These six devices are all soldered in parallel, with the cathode end of the diode connected to the coax center conductor and the anode end connected to the shield. With a short piece of wire loosely coupled (one loop) around the *signal generator* and inserted into the Drake N-connector, I transmitted a 1 Watt CW signal at 29.9999 (the upper limit on my HF rig) into the signal generator in order to receive the signal at 143.9992 on my two meter rig (30 x 80 = 2,400). Tuning was smooth and easy—but small adjustments make a very fast frequency shift. I also noted the Drake drifts about 3 kHz in the first five minute warm-up period.

Go!

But what about testing it on a satellite? Fortunately, UO-11 has a beacon at 2401.500 MHz. I quickly cobbled together a 10-turn helix with a ring reflector (*see http://members.aol.com/k5oe/trio_ant.htm*) , fixed it at 45 degrees elevation, and waited for the next pass. On the first attempt I picked up the beacon at about 20 degrees elevation at 2401.530 (145.530) MHz and followed it up through 57 degrees elevation and back down to 20 degrees where it was now at about 2401.470 (145.470) MHz. Signal levels were S3 for about half the six minutes I copied the beacon, against an S1 background: success by any measure.

Reflections

I used a casually constructed, untested and unproven antenna. Still, I was able to copy the beacon with ease. If you consider UO-11 is ½ Watt at 2,000 km and Phase 3D will be 50 Watts at 40,000 km, you could still hear Phase 3D at apogee - being only about 6 dB down from the above comparison signal. And this does not even take into account the high gain antenna on Phase 3D. Just imagine how good it would be with a high-gain antenna at the ground station as well.

73 es listen for me on mode U/S. ■

Observations from Norway

John A. Hackett, LA2QAA

Doppler

As is,or by now, *should be* commonly known, the only correct way to tune for Doppler is to maintain a **constant** frequency at the satellite transponder. This ensures we do not wander over each other's QSO's. (S*ince* **full duplex**, by some, still seems to mean if you can hear someone else using the frequency turn up your power and **clobber** him!)

Those having more money than sense have been privileged in the fact that they can afford the latest all singing, all dancing auto-tuning rigs, even for inverted transponders. But what about the other 97 percent of us? Do we continue to tune **both** the transmitter and receiver to maintain a constant frequency at the satellite? **No!**

Anthony Monteiro AA2TX has given us the program **InstantTune** which is primarily designed for the InstantTrack tracking program. (InstantTune is downloadable **free** from the AMSAT-NA website).

The InstantTune program, like several others can drive CAT rigs via COM ports but it can also drive *any* rig with microphone push-button control including my ancient Multi-750-A 2m transmitter and TR-851E 70cm receiver by the use of parallel ports. The program also supports *any* converter, up or down and is therefore is ok for the microwave frequencies on Phase 3D (If and when!.....G7NFO).

Since I only have one printer port on my PC it was impossible to test the autotracking function of the up/down frequencies directly so I built two small interfaces for the TX and RX using my 486 machine for the RX and an old 386 for the TX. Carefully setting the PC clocks accurately ensured that the TX and the RX frequencies would *track.* Of course to get the full effect the program needs to be run on a single PC since it checks the RX frequency every second and adjusts the TX frequency to match. The program drives the RX frequency to maintain a constant frequency at the satellite. In other words, you can tune in a station on your receiver and your transmitter will automatically change to the correct frequency (or vice-versa).

By using two PC's that didn't happen for me of course but the TX and the RX tracked separately and always remained at a constant 581.797MHz difference when I was tracking FO-20 which is an inverting transponder. In other words...it was correct and **did** maintain the correct frequency at the transponder throughout the pass when operated with the InstantTrack. I was impressed!

As mentioned, the high priced rigs already have inbuilt auto-tuning but for those of us who only *dream* of these rigs InstantTune allows us to do the same thing automatically with *any* combination of rig(s).

The interface only needs four lines: UP, DOWN, COMPLETED TUNING and GROUND (no IC's, etc). It uses the 5V on the parallel port.

Since both of my rigs need a signal to GND to operate the UP ands DOWN buttons I built 2 small boxes from double sided PCB and mounted a pair of miniature double pole PCB relays in each box together with an ON/OFF switch and 9 pin connectors for the signals from the parallel ports. Also on the box is a phono connector for the +12V needed to drive the relays. The LPT port signal via a 4.7 ohm resistor to the base of a BC107 transistor switches the relay on or off thereby clicking the microphone button switch UP or DOWN. (The *complete* signal stops the process and lights the appropriate LED). One side of each relay drives the UP and/or DOWN and the other side drives a LED. (I love lots of pretty lights as it makes the uninitiated think I know what I'm doing!) **[continued on next page]**

I used a red LED for UP, Yellow for DOWN and green for COMPLETE. The COMPLETE signal (5V) can drive a LED directly via a 220 ohm resistor. (No relay needed). Of course if you have rigs that use 5V you won't need the relays!

This system should be *right up your street* if like me you *don't* own an FT-847 but still want to tune for Doppler correctly **without** *messing* with your VFO's throughout the pass, or arguing with the chap at the other end of the link as to who's tuning correctly. **If you maintain a stable frequency at the satellite you're tuning correctly!**

YK2 and *InstantTrack*

Since we're approaching *YK2* at a rapid rate of knots I was rather concerned that the promised YK2 compliance update for InstantTrack wasn't forthcoming...(wasn't fifthcoming either.....GM1SXX). I decided to do some *digging* via a couple of prominent AMSAT-NA members. I was informed that the long awaited update **would** appear before the first of January 2000. As luck would have it, the very same day SPACENEWS ticked in informing us all that someone had already done the *groundwork.* Jean Blineau, F6HCC has added to one of Richard Limebear, G3RWL's earlier KEP programs such that his version (called **CVITK**) allows InstantTrack to be updated with KEPS **after** the year 2000. (It works! I've tried it! LA2QAA).

The program is available via *http://www.amsatnet.com* as well as the packet network. You can also contact Jean at *f6hcc@amsat.org*. Jean also informs me that there will be a *final* version in January if any problems should occur. **Well done Jean!**

Unfortunate

I had great plans for this issue including some photo's to back up the usual *waffle* but *even the best laid plans.....* I suffered two heart attacks in the space of two days and have consequently spent several very boring days in hospital. (Will nothing keep this man from getting his callsign in *The AMSAT Journal* and *OSCAR News???....* GM1SXX).

To make matters worse they wouldn't give me permission to set up my satellite station in the intensive care ward. Apparently the other patients would object to the antenna array at *feeding time.* (Spoilsports!.....G7HIA). Consequently the...*best laid plans*...didn't get laid this month.

Therefore I apologise for not responding to all the AMSAT members who sent me best wishes for a speedy recovery. Special thanks to GM1SXX for the 10.000 (imperial) gallons of Olive Oil to save me from my fatty egg n' bacon cooked in butter! The Specialists tried to convince me to eat raw fish but Norwegian I'll ***never*** be. (They ***are*** nice people really, even if they do eat raw fish!)

Special thanks also to Sam Jewell, G4DDK.....he knows why....you! don't need to.

By the time you read this I trust the Plum Duff and consequential indigestion has abated somewhat. I would like to wish everyone a prosperous new Millenium, (I don't suppose many of us will *see* the next one) but lets hope Phase 3D does eh?

73 John, LA2QAA. ■

Microwaves: Easy or Difficult?

Allan Copland GM1SXX (*gm1sxx@amsat.org*)

When Phase 3D gets into orbit, if the spacecraft designers have done their sums right, the question of whether or not the newcomer should set up a Mode B station or a system based on microwave equipment will rear its ugly head. Assuming that Phase 3D has a successful launch and deployment, what should be the answer to that question? I for one, don't think there will be any contest … microwaves will win hands-down. Unless ***terrestrial*** 2M and 70Cms operation is the beginner's main area of interest, they would be well advised to go down the microwave path. Mode LS (23cm up ~13cm down) looks like it will become the mode of choice!

Irrespective of the fact that the microwave bands are generally accessed by means of transverting from 2M or 10M using a standard multi-mode radio, the additional cost of antennas, feedlines and power amplifiers required for mode B operation would be more wisely spent on transmit and receive strips for the lower microwave bands. This would give the best of both worlds …. 2M & HF terrestrial transmit & receive (albeit 'barefoot') … maybe with homemade antennas … with the option of satellite TX/RX on the lower microwave bands.

Using one of LMW Electronics' UNVLO2 sources and 2M multi-mode rig feeding the SSB Electronics 23cm transmit converter (USM-3) and a Mitsubishi M57762 *brick* amplifier results in a useful 15-18 Watts of RF power on 23cm SSB. The equipment is small and light and can be mounted at the antenna with relatively cheap coax feeding it. A helical antenna for 23cm can easily fit on a decent camera tripod or be mounted on a clothes drier *whirly* in the style of John Hackett, LA2QAA … ask the wife's permission first! The downlink equipment can be a 13cm helical (even smaller) directly feeding a Drake 2880 receive converter (suitably modified for the 13cm satellite sub-band) feeding a 2M receiver.

Now, before you get carried away at the expense of all this, remember that the antennas can be made from junk, you don't need any expensive cables ... the antennas can be bolted straight onto the brick PA and Drake downconverter with RG58 cables running back to the shack … and the Mitsubishi 'brick' amplifier only costs around $130 This is for the amplifier module, PCB and all board mounted components. Drake converters cost about $40-$50 plus the cost of a new crystal and the SSB mixer / PA driver (USM-3) costs $150 in kit form. This is less than I paid for mine; and it is now quite a few years old. Who says that prices always go up! [This price quote is current, I phoned Piper Communications today (18DEC99) and £91 (about $150) was the price quoted for the USM-3 mixer kit.] If you decide to *wimp out*, the USM-3 mixer can also be bought ready-built at £140.73 (about $225) from Piper communications … but then you'd miss the fun of building it .. and be much poorer.

Now, answer this question honestly. How much does a decent linear amplifier, a couple of good quality coaxial cable runs and a pair of antennas for 2M and 70Cms cost? The honest answer ….. a lot of money!

Can you solder? Have you ever done any kit building before?

If you can answer yes to both of these questions, **you** can put together a quality microwave communications system that would be the envy of many using only basic hand tools. Anyone reading this who has passed the novice class Amateur Radio examination should be capable of building a suitable station with only limited guidance from an *Elmer*. You *will* need an Elmer to assist in tuning everything up … the use of a frequency meter is essential at some points in the construction and calibration …. But **please**… don't think that you cannot do this. After all, its only radio. None of these kits are difficult to build. The local oscillator unit and Mitsubishi 'brick' amplifier make use of some SMD components, but they are ***not*** of the midget types and there is loads of space around them on the PCB. They are not difficult to solder if you follow my tips in my recent article on the UNVLO2 local oscillator (see November/December issue of *The AMSAT Journal*). You don't actually need to know how it all works to build and use this technology… it just helps if things go wrong. The golden rule in microwave construction …. **never** be afraid to ask for help.

If you have access to the internet, look up James Miller, G3RUH's articles. You will find them at *www.amsat.org\amsat\articles\g3ruh\g3ruh-index.html* Download and read the file a115.zip. If this article doesn't change the way you think about what sort of satellite transponders we should be using then I've been wasting my time writing this!

The *Techies* Toolkit

If you want to start constructing your own equipment, I'd rate the following as *essential* equipment:

- A decent low power soldering iron of around 30W rating (I use the cheapest Weller 24V temperature controlled model).
- High wattage soldering iron - for seam soldering PCB's into cabinets and the like. Big is good! I use a 90W iron with a wide chisel tip.
- Reel of fine solder (for SMD work) and a reel of standard solder.
- Selection of small screwdrivers .. plain & crosspoint.
- Pair of long nosed pliers and a pair of small side cutters.
- Set of trimming tools – the cheap plastic sort are ok
- A decent (20k/volt or better) moving coil multimeter (digital meters are useless for tuning purposes!)
- Home made diode probe (for tuning up filters etc)
- Pair of fine nosed tweezers (stainless steel ones are best) or some wooden cocktail sticks (for holding SMD components while soldering)
- Solder sucker (or solder mop) … for repairing mistakes!
- Hacksaw
- Small hammer
- Ruler (or yardstick)
- Patience & perseverance … rush jobs = poor results.
- An Elmer.
- You'll also need a stable 12V (nominal 13.8V) power supply to power your projects. There are many suitable kits available from companies such as Maplin. A simple variable voltage 1 amp supply is suitable for most construction projects. I don't recommend the use of batteries such as car batteries or lead-acid 'gel' cells. They are capable of frying your expensive PCB foils to a crisp in the event of an accident. You have been warned! A good power supply will soon repay its modest cost.

Armed with these items, you can build most things. If you find something is beyond your facilities, like cutting sheet metal neatly, ask someone for help. That's what I do. Patience, perseverence, and an Elmer are among the most important, and don't even cost anything.

Post Script

If you've read LA2QAA's Observations from Norway in this issue, you will be aware that the other half of the Hackett & Copland Microwave Co has been very ill. I wasn't too happy to hear that he'd 'escaped' from hospital and gone to ground on Frei Island. I've been in touch with him since and after a 30 minute phone call he assures me that he's planning to behave himself and take the doctor's orders seriously. Somehow I doubt that as he's way too much like myself, hates hospitals as too many sick people hang out there!

When I telephoned, his wife picked up the telephone. I asked to speak with John. There was a long silence punctuated by the sound of John climbing down those 'wooden hills' after which he told me that his Missus said "There's someone on the phone for you. I don't know where he's phoning from. He doesn't speak Norwegian and he doesn't definitely doesn't speak English either!" Hmmmmmm!! Here's wishing John a speedy recovery.

73, Al, AMSAT-UK #3286.

Equipment Suppliers

Piper Communications' (USM-3 mixer/pa) are at UK telephone 0123-583-4328.

LMW Electronics (UNVLO2) are at UK telephone 0153-023-1141 WWW: *http://www.lmw.co.uk/*

Mainline Electronics (Mitsubishi 23/24 cms 'brick' PA kit) are on UK telephone 0116 -277-7648 ■

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AMSAT-UK 15th Colloquium Call for papers

The 15th AMSAT-UK Colloquium, *AMSAT Space 2000*, will be held at Surrey University, Guildford, Surrey, U.K., from Thursday, 27 July to Sunday, 30 July 2000.

AMSAT-UK invites authors to submit papers, about Amateur Radio space and associated activities, for this event and for the proceedings document which will be published at the same time. We normally prefer authors to present the papers themselves rather than having someone else read them in the authors' absence, but we also welcome un-presented papers for the document.

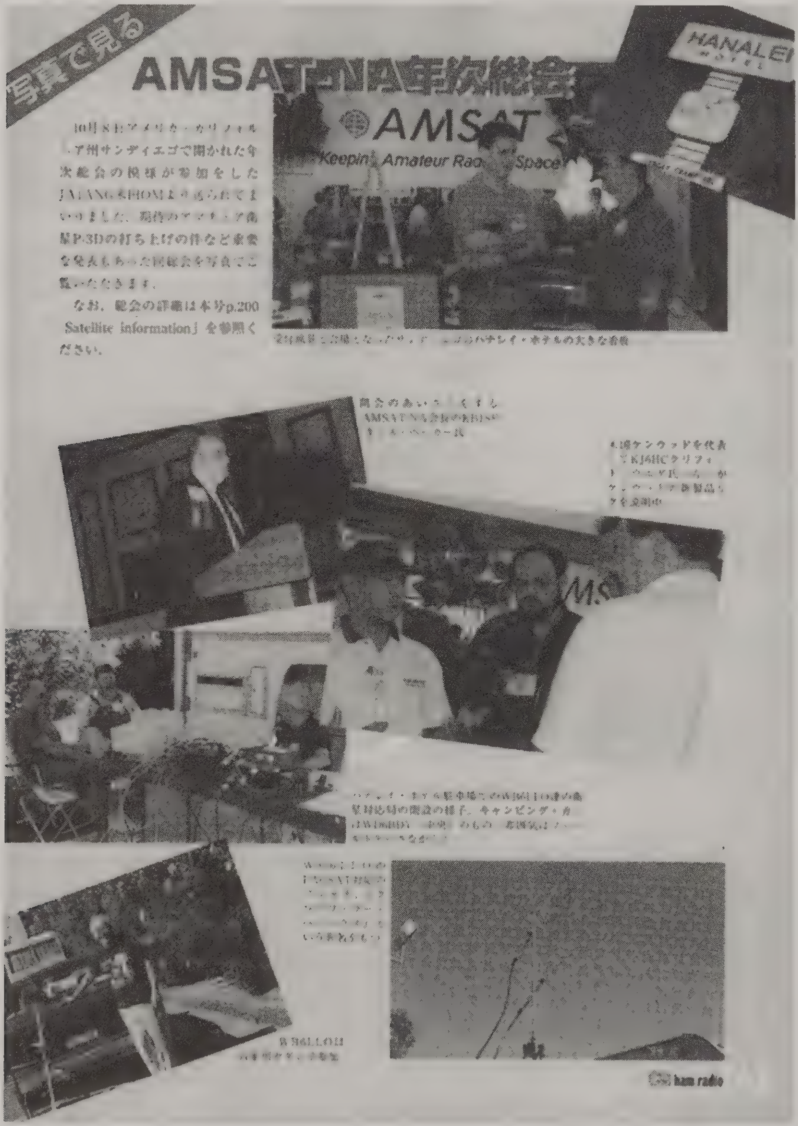
Offers of Papers should be submitted as soon as possible; the final date for full documents to be received is mid-June 2000 to allow the proceedings document to be available to participants. A second (and final) call for papers will issue about March 2000, probably at the same time that the colloquium booking information becomes available.

Submissions should be sent only to Richard Limebear, G3RWL, via the following routes:

- Internet E-mail: *g3rwl@amsat.org*
- Packet Radio: *G3RWL @ GB7HSN.#32.GBR.EU*
- Terrestrial mail: R W L Limebear G3RWL, 60 Willow Road, Enfield, EN1 3NQ, United Kingdom.

AMSAT-UK also invite anyone with requests for Program Topics to submit them as soon as possible to G3RWL. Invitations for any papers on specific subjects will be included in the future call. Obviously we are hoping for many presentations about the new Phase 3D satellite but we still want to hear about other activity areas.

Additionally, AMSAT-UK will be running sessions specifically for beginners to amateur satellite operating on the Saturday; volunteers are requested to speak to these sessions.



AMSAT San Diego Symposium on the Cover of Japanese CQ magazine! Shinji, JA7QHM recently sent Dave and Leanore Guimont a copy of the cover from Japanese CQ magazine depicting photos from the 17th AMSAT Annual Meeting and Space Symposium held in San Diego last October 1999.

38k4 baud Satellites

Stacey Mills, W4SM recently commented on amsat-bb that if you're tired of the *slow* 9k6 baud sats, now may be a good time to look into what it takes to go to the 38k4 downlinks:

At least two of the current satellites, TO-31 and UO-36 have this capability and Phase 3D's RUDAK has multiple high speed modems and is likely to be very active at 38k4, as well. Several of us have been working with Chris Jackson to tweak WiSP to function best with these new satellites, and I believe that they (at least UO-36) will be widely available soon. Even now UO-36 is often transmitting at 38k4 baud over the US (437.025 MHz) during daylight hours.

The uplink on these satellites is 9k6 baud, so if you're active on UO22/KO25, etc., no changes are needed on the transmit side. However, the extreme bandwidth of the downlink at 38k4 necessitates some receiver changes as all of the current ham rigs are too narrow banded to handle this. However, there is a very good, relatively inexpensive solution. Symek (*www.symek.com*), a German company in Stuttgart, makes a small receiver/demodulator board that intercepts the data stream from your transceiver's IF. These IFD boards cost DEM 235 (about $122). They come with excellent installation instructions (in English if appropriate) and are available for most of the major satellite transceivers and receivers used by amateurs. If you don't see your rig listed, drop them a note and they'll work with you to get you an IFD board. I ordered using a credit card over the Internet and my modules were received in a few days. I've installed one in a Yaesu FT-736R and another in a Kenwood

TS-790A. The Yaesu installation is very simple and the Kenwood is only a little more involved. Anyone comfortable making the 9k6 baud modifications should easily be able to handle this. Importantly, normal function of the radio is not affected.

With regard to a modem that will handle 38k4 downlinks, there may be several options. I've been told that a standard G3RUH 9k6 FSK modem can be adapted to run at this speed. There's also been discussion that a DSP56002EVM board is capable (just) of running at this rate and some software may be available for this modem on the TAPR web site. I have not pursued either of these solutions, so I can't comment further.

Symek has two very high-speed modems (up to 614K baud!) that work extremely well. One is a two-port version (TNC3S) and the other, less expensive one is single port (TNC31S). These can be ordered from the factory in any specified configuration. I have the less expensive TNC31S. Mine is set up to wake up in KISS mode with 38k4 downlink, 9k6 uplink, and a 57k6 PC connection.

The downlink at 38k4 on UO-36 is really spectacular! Watching the byte counter fly by is quite a treat. Efficiencies of 90-100 percent are easily obtained with directional antennas and a preamp. Doppler tuning is not really necessary on the widebanded 435 MHz downlink. Downloads of 1.5Mb are possible on single passes, and all three components of a color image can be captured in short order. I used to think 9k6 was fast, at least compared to 1k2 on AO-16, now when I look at KO-25/UO-22, the byte counter seems to be moving in slow motion!

To me at least, this high speed (Internet level) transfer rate, and the ability to grab images on a single pass, really brings some excitement back to the digital satellites.

Hope to see you in the queue(s) soon.

AO-27 TEPR States Explained

Chuck Wyrick, KM4NZ, Acting AO-27 Control Operator recently provided the following description of AO-27's TEPR states:

AO-27 uses a method called Timed Eclipse Power Regulation (TEPR) to regulate its batteries. In simple terms, TEPR times how long the satellite has been in the eclipse or in the sunlight and then decides what subsystems to turn on or off.

The current software onboard AO-27 breaks an orbit into the following six different states:

- TEPR State 1: Starts when the satellite enters the Eclipse
- TEPR State 2: Starts a programmed time after TEPR State 1 (Still during the Eclipse)
- TEPR State 3: Starts a programmed time after TEPR State 1 that's after State 2 (Still during the Eclipse)
- TEPR State 4: Starts when the satellite enters the sunlight
- TEPR State 5: Starts a programmed time after TEPR 4 (Still in the sunlight)
- TEPR State 6: Starts a programmed time after TEPR 4 that's after State 4 (Still in the sunlight)

Current Subsystems by State:

- TEPR 1,2,3: all unneeded subsystems are turned off (This is why there is no nighttime use of the satellite)
- TEPR 4: AO-27's transmitter is turned to exciter power only. All other transmitters are off.
- TEPR 5: AO-27 transmitter is turned to 0.5 watts (low power)
- TEPR 6: All of AO-27's unneeded subsystems are turned off

Using this description, during a descending, daytime pass, AO-27 will enter TEPR 4 after coming out of the eclipse and will start to recharge its batteries. We program the TEPR 5 time so the satellite will stay in TEPR 4 until the footprint reaches latitudes equal to the northern United States. At that time, it changes to TEPR State 5 and the transmitter turns on. The duration of TEPR State 5 is set for the longest we can leave the transmitter on to keep the batteries in a state that will prolong their lifetime. During summer in the northern hemisphere, this is 18 minutes. If we were to leave it on longer we would start to limit the lifetime of the satellite as TEPR 6 period needs to be long enough to recharge the batteries before we enter the eclipse again (TEPR 1).

So, the time AO-27 needs to stay in TEPR 6 is what places a limit on what southern latitudes can work the satellite.

As an example, we can set AO-27 to charge its batteries for "x" number of minutes *after* it enters sunlight. This is TEPR state 4 expressed in 30-second increments, e.g. TEPR 42 means that the charging time is 21 minutes. We then set TEPR state 5 to the length of time, expressed in 30 second increments, that the transmitter would be on from the start of TEPR 4 but not on until the completion of TEPR 4. For example, TEPR 78 means that the transmitter will shut off 39 minutes after the start of TEPR 4, but the transmitter will be on for 18 minutes (78 - 42 = 36, or 18 minutes).

Amateur Radio Scholarships Available

The Foundation for Amateur Radio, Inc., a non-profit organization with headquarters in Washington, DC, plans to administer seventy-three (73) scholarships for the academic year 2000-2001 to assist licensed radio amateurs. The Foundation, composed of over seventy five local area Amateur Radio Clubs, fully funds ten of these scholarships with the income from grants and its annual Hamfest. The remaining sixty-three are administered by the Foundation without cost to the various donors.

Licensed radio amateurs may compete for these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled in or have been accepted for enrollment at an accredited university, college or technical school. The awards range from $500 to $2500 with preference given in some cases to residents of specified geographical areas or the pursuit of certain study programs. Clubs, especially those in Delaware, Florida, Maryland, Ohio, Pennsylvania, Texas, Virginia, and Wisconsin, are encouraged to announce these opportunities at their meetings, in their club newsletters, during training classes, on their nets, and on their World Wide Web home pages.

Additional information and an application from may be requested by letter or QSL card, postmarked prior to 30 April 2000 from: FAR Scholarships, PO Box 831, Riverdale, MD 20738

The Foundation for Amateur Radio, incorporated in the District of Columbia, is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1954. It is devoted exclusively to promoting the interests of Amateur Radio and those scientific, literary, and educational pursuits that advance the purposes of the Amateur Radio Service.

Houston AMSAT Net Moving to TVRONet

The producers of the weekly amateur radio *Houston AMSAT Net* have announced their program will be moving to a new satellite carrier effective Tuesday, 4 January 2000. An agreement has been reached with Keith Lamonica, W7DXX, of Boston, Massachusetts, and Dana Pretzer of Weyburn, Saskatchewan, Canada, to air our net on their TVRONet, which also carries other technical and hobby-related programming.

TVRONet can be found on "C" band on GE Americom Spacenet 4, transponder 16 upper (H), 5.8 MHz wideband analog audio subcarrier (4.020 GHz), located at 101 degrees west longitude. It can also be found on 4DTV satellite S4, channel 952.

Our first net with the W0KIE Satellite Network operated by Mike Reynolds, W0KIE was on 6 June 1996 and we have been with them since then. With the loss of transponder time on the Wisdom Channel, the Houston AMSAT Net sought alternative solutions.

Houston AMSAT Net producer, Bruce Paige, KK5DO is "saddened to lose such a long relationship as that with the W0KIE Satellite Network and hopes that our paths will cross again one day." Net Control, Andy McAllister, W5ACM commented that "the W0KIE Satellite Network was one of the most stable satellite feeds that we had over the many years of our net."

The first satellite link of the Houston AMSAT Net began 2 February 1994 on Telstar and has continued through many different Network feeds since then. The W0KIE Satellite Network being the longest. RealAudio live server and delayed listening was started on 23 July 1996.

The Houston AMSAT Net with this move, joins This Week In Amateur Radio (TWIAR) which has also moved to TVRONet. The Houston AMSAT Net provides information to the amateur community on satellite, balloon, and space topics each week during their one hour net on Tuesday evenings at 2000 hrs Central Time. It originates on the 147.100 MHz FM repeater in Houston, Texas and is carried by many repeaters throughout the country. Those unable to listen on the satellite or local repeater may listen to the net at *http://www.amsatnet.com*. We also utilize an Internet Relay Chat during the net to take check-ins and take questions.

For further information or questions, please contact Bruce Paige, KK5DO at *kk5do@amsat.org* or visit our web site at *http://www.amsatnet.com.*

VHF-UHF Pioneer Paul M. Wilson, W4HHK, SK

VHF-UHF pioneer Paul Wilson, W4HHK, of Collierville, Tennessee, died 29 November 1999. He was 75. A stalwart in the 144-MHz and Microwave Standings, Wilson remained active right up until his health deteriorated earlier this year. In early July, he completed his VUCC on 10 GHz. He celebrated his 75th birthday in September by making his first contact on 24 GHz.

''Paul's life should inspire every amateur to strive to always try something new in Amateur Radio, regardless of age or health,'' said ARRL Vice President Joel Harrison, W5ZN—a friend of Wilson's. ''He has definitely been an example for me.''

Wilson got his ham ticket in 1941 at the age of 16. While still in high school, he began experimenting on the old 2-1/2 meter band (112 MHz). After World War II, he rekindled his interest in VHF and UHF, becoming a major figure on the then-new 2-meter band.

During the 1950s, he got involved in meteor scatter propagation. In 1954, W4HHK and Tommy Thomas, W2UK in New Jersey sent and received reports via 2-meter meteor scatter over a 950-mile (1520 km) path—a first! W4HHK and W2UK won the ARRL Technical Merit Award for 1955.

Wilson took on the challenge of Earth-Moon-Earth propagation as well, and in 1961 he began work on an 18-foot dish. He was among those making their first 70-cm EME contacts in July 1965. From that frontier, he moved on to attempt 2304 MHz moonbounce, and he won the ARRL Technical Merit Award for 1969 for his work on that band. In 1970, W4HHK and W3GKP claimed a new record—the first 2304-MHz EME contact.

In 1972, Wilson used his 18-foot dish to monitor the Apollo X command module on 2.2 GHz as the astronauts orbited the moon. He received a NASA confirmation of his reports in the form of a photograph signed by all the astronauts on the mission.

Noted VHF-UHFer Al Ward, W5LUA, called Wilson "a true VHF pioneer and said he would be missed." "Paul's signal on 2304 EME was like a beacon station, and his presence will be missed by all who have worked him in the last 29 years off the moon," Ward said. The Central States VHF Society awarded Wilson its Chambers Award in 1986 for "his continuing technical contributions to UHF, especially EME on 13cm."

Wilson retired in 1980 after 30 years as an engineer for TV station WMC in Memphis. His wife ''DB''—to whom he was married for 54 years—is W4UDQ. His son, Steven, is N4HHK. A service was held 2 December 1999 in Collierville, TN. (*via ARRL Newsletter*)

Charles 'Chod' Harris, WB2CHO/VP2ML, SK

Former AMSAT member, ARRL staffer and CQ magazine DX columnist Charles 'Chod' Harris, WB2CHO/VP2ML, of Santa Rosa, California, died 8 December 1999. Harris suffered from complications from a severe heart attack he suffered in early November. He was 50.

An ARRL Life Member, Harris was first licensed in the late 1960s. He was an honor graduate of Princeton University and president of the school's Amateur Radio club. In the mid-1970s, Harris ran the ARRL Club and Training Department. An active contester and active DXer, Harris had operated from several exotic locations. He obtained the callsign VP2ML while living on the island of Montserrat in the late 1970s and early 1980s before moving to California.

Y2K Compliance for SatTrak III and SatTrak IV Track/Tuning Boxes

Graham Ratcliff, VK5AGR, has prepared new firmware which adds Y2K compliance plus other improvements.

The binary files for programming 27C512 eproms can be found at:

- *www.amsat.org*
- *ftp.amsat.org*
- *software\sattrak\st3_y2k.zip and \st4_y2k.zip*

The file names depending on your display and radios for SatTrak III are:

- s32444ik.bin
- s34444ik.bin
- s32444yi.bin
- s34444yi.bin

The file names depending on radios for SatTrak IV are:

- st4312ik.bin
- st4312yi.bin.

The zip files include documentation updates.

JAWSAT Launch Delayed

Florida Today is reporting the maiden flight of a new U.S. Air Force booster known as Minotaur - a hybrid combining the first two stages of a decommissioned Minuteman II intercontinental ballistic missile (ICBM) with an Orbital Sciences Pegasus rocket - was aborted Friday evening, 14 January 2000 and again on Saturday morning, just moments prior to launch. The launch vehicle contains the JAWSAT Amateur Radio satellite platform (see the September/October 1999 issue of *The AMSAT Journal*).

Officials at the Vandenberg launch site halted the first countdown when the auto sequence start command was not received with just two minutes remaining in the countdown. The problem was rectified and the launch team recycled the Minotaur for a second launch attempt just before the close of the three-hour launch window. Again, with just seconds remaining on the countdown clock, a second launch attempt was halted when the Minotaur's onboard batteries dropped below required power levels.

The Minotaur's first mission, planned as a test flight to evaluate the former ICBM's capability as a satellite launch vehicle, will carry Air Force and NASA experiments and several small student-built spacecraft such as JAWSAT and OPAL. Next launch attempt for the Minotaur is set to occur no earlier than 22 January 2000.

Monitor the AMSAT News Service and *The AMSAT Journal* for additional JAWSAT details. [via AMSAT News Service]

AMSAT-DC Meeting Announcement

Pat Kilroy, WD8LAQ reports that all space enthusiasts and amateur satellite operators are invited to the next Maryland-DC area AMSAT Meeting and Space Seminar. This includes students, teachers, parents and all Amateur Radio operators too! The gathering will take place on Sunday, 2 April 2000, starting at 1:00 PM EDT in the auditorium of the beautiful Visitor Center at the NASA Goddard Space Flight Center in Greenbelt, Maryland.

All topics at the seminar will relate to the amateur space program, Amateur Radio, high-altitude balloon experiments, telemetry, homebrew electronic projects, and similar fun with technology. The format is a combination of presentations, informal *show 'n' tell* demonstrations and a social period. The first presentations and the keynote address are designed to be especially valuable to beginners. All aspects of this seminar are brought to you by unpaid, uncompensated volunteers. The high quality of past AMSAT-DC seminars have received excellent reviews so the entire afternoon looks to be great fun!

An informal talk-in will be available on WA3NAN/R 146.835 MHz, Greenbelt, MD.

For APRS users, the meeting place coordinates are roughly 38°59'34.8" N, 76°50'48.8" W.

Changes and the latest meeting developments are posted on the Local Maryland-DC Area AMSAT web page at *http://garc.gsfc.nasa.gov/~simsat/ssamsatdc.html*.

The GSFC Visitor Center will be open to the public on this day between 9:00 a.m. and 4:00 PM. Visitors can enjoy a walking tour of the Hubble Space Telescope Operations Control Center and the NASA Communications (NASCOM) Center at 11:00 AM. (The tours are available to 4th grade and above and approximately one hour long.) Model rocket launches will be at 1:00 PM and will be for all ages.

The Educator's Resource Center (ERC) on the VC upper floor is also available to those gathering materials for students and the classroom. Free paved parking. For additional Visitor Center information please call 301-286-8981 or go to the web site *http://pao.gsfc.nasa.gov/vc/vc.htm*. For a map and directions go to *http://pao.gsfc.nasa.gov/gsfc/welcome/gsfcmap/gsfcmap.htm*.

There will be a special tour of the Goddard Amateur Radio Club Station WA3NAN, *Voice of the Space Shuttle Retransmissions* at 12:00PM originating at the club site. Visit *http://garc.gsfc.nasa.gov/www/garc-home-page.html*. Cash donations will be accepted to offset the associated seminar costs. Also each AMSAT member attending can also donates in one or more of the following ways by helping to:

- Plan presentations and activities.
- Monitor the 146.835 MHz repeater for talk-in during any period starting before 11:00 AM through an hour after the start of the seminar.
- Bring a *show 'n' tell* item to demonstrate at a table.
- Act as a greeter at the door of the auditorium for sign-in, name badge writing, welcoming, etc.
- Bring a beverage or some munchies to share.
- Act as a speaker timekeeper for the host.
- Take notes and then mail a summary to *amsat-dc@amsat.org* within about a week or so.
- Act as our official photographer or videographer.
- Recognize a need and jump in to take action.
- Move chairs and tables back and clean up.
- Arrange a good place for a group to dine immediately afterwards for those who wish to participate.
- Develop an AMSAT-DC scrapbook; collect and share materials on meeting topics, people and activities for historical record and one's appreciation.

This meeting is open to all so please spread the word. The gathering is scheduled to end at 4:00 PM. In the past, the Goddard security officers have allowed us to drag out the ending a little while longer so please be flexible.

Links to all World Wide Web addresses listed in this issue of *The AMSAT Journal* are available via the AMSAT World Wide Web Site.

Selective HEMT Preamp for 13cm

Michael Kuhne, DB6NT (*kuhne.DB6NT@Baynet.de*)

Editor's Note: This article originally appeared in the August 1999 issue of "Anomalous Propagation," the monthly newsletter of The Midwest VHF-UHF Society. Many thanks to "Anomalous Propagation Editor Gerd Schrick, WB8IFM for allowing us to reprint this article.

The LNA described here is suitable for all modes: ATV, OSCAR, SSB/CW, etc. The goal was for easy building and aligning with the following specifications:

- The input connector permits direct connections to the coax relay avoiding intermediate adapters.
- The supply voltage can be fed through the coax or externally using a feedthrough capacitor and built-in low pass.
- Low noise figure, typically 0.7 dB.
- High amplification to compensate for long cable lengths.
- A helical filter is used after the first amplifier stage to avoid overloading of the second stage and the following receiver from out of band signals.
- Electrically stable to avoid tendency for oscillations even with poorly matched antennas.
- Simple construction using a PC board with plated-through hole and SMD components.

Circuit

The amplifier is built using an HEMT-FET (High Electron Mobility Transfer) in the input followed by a GaAs MMIC. The input stage is matched for wide-band low noise and does not use RF elements that require tuning. The circuit was adopted from DJ9BV (Figures 1 and 2) and modified for easy construction on a single Teflon circuit board. The negative gate voltage for the HEMT is obtained by the ICL-7660; the operating point is adjustable by a potentiometer. Voltage for the transistor is supplied using a LCR network. The source inductance (negative feedback) and the de-coupling resistor between the drain and helical filter achieve electrical stability. This (negative feedback) and the de-coupling resistor between drain and helical filter achieve electrical stability. This resistor can be varied from 10 to 39Ω, however, it influences the amplification and noise figure. The helical filter #2450 by NEOSID can be turned over the entire Amateur Radio band and has 50Ω input and output impedance.

The second stage employs the GaAs MMIC MGS86563. Its operating voltage can be between 8 and 24 volts at approximately 30 mA of current. A built-in filter permits feeding through the coax cable. Polarity protection is also provided. Direct (external) supply voltage can also be provided through a feedthrough capacitor.

Construction

- Drill the tin sheet metal housing according to Figure 3.
- Mount the coax jacks and feed through capacitors and solder the circuit board all the way around to the box.
- Mount and solder the helical filter.
- Solder all SMD components.
- Solder all GaAs components NE42484 and MGA 86563. Soldering the MGA requires a *steady hand* and a *good eye*; a magnifying glass and small solder tip with SMD solder is recommended. Also ESD measures should be applied, the soldering iron connected to the building project (grounded).
- Clean the entire board with alcohol to remove any remnants of flux.
- Apply absorbing foam rubber to the lid covering the SMD component side of the box to prevent resonances from the enclosure.

Alignment

After applying the operating voltage the drain voltage for the NE424 should be set to 2 volts with the 1k potentiometer. Next the helical filter is alternatively tuned for maximum gain and lowest noise figure (Figure 4). That's it!

The amplifier has been duplicated a number of times and always achieved gains between 35 and 40 dB. The noise figure is around 0.7 dB. No tendency to oscillate was detected even with the antenna pulled.

Note that is possible to build a single stage verision with 15dB of gain on a slightly modified PC board (Figure 5).

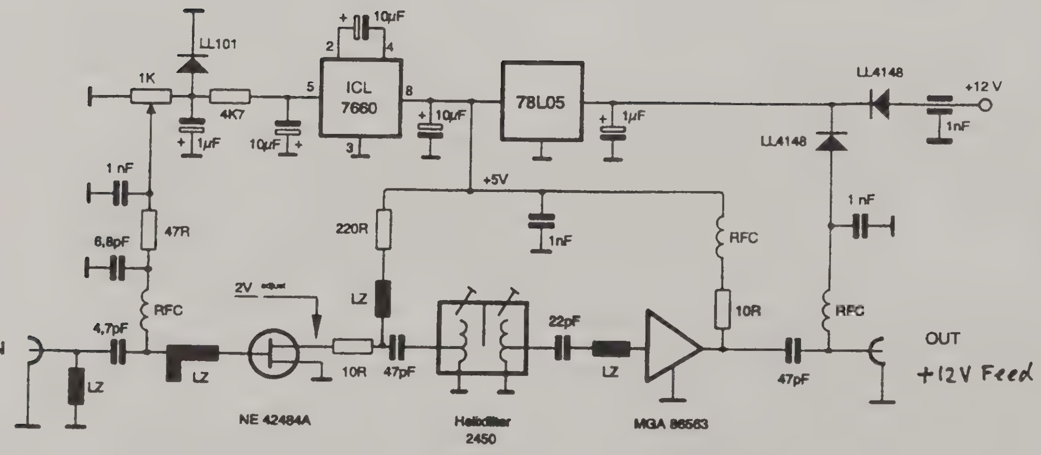


Figure 1. 13cm HEMT Preamp Circuit Diagram.

Acknowledgements

I would like to thank DL6NCI, DK2DB, DF9LN, and DL3NM for building samples, testing them, and providing many tips and suggestions. Furthermore, I would like to thank Ulli, DC8SE for providing numerous parts and Mr. R. Schulze Hoeing of Mauritz Company for providing the PC board material and sample boards.

Sources

- PC Boards: Eish Electronics, Abt-Ulrich-Str. 16, D-89079, Ulm-Goegglingem, Germany. Telephone: 0114-973-052-3208. Facsimile: 0114-973-052-3306.
- Kuhne Electronics Complete Amplifier: SSB Electronic, 124 Cherrywood Drive, Mountaintop, PA 18707. Telephone: 570-868-5643 *http://www.ssbusa.com.*

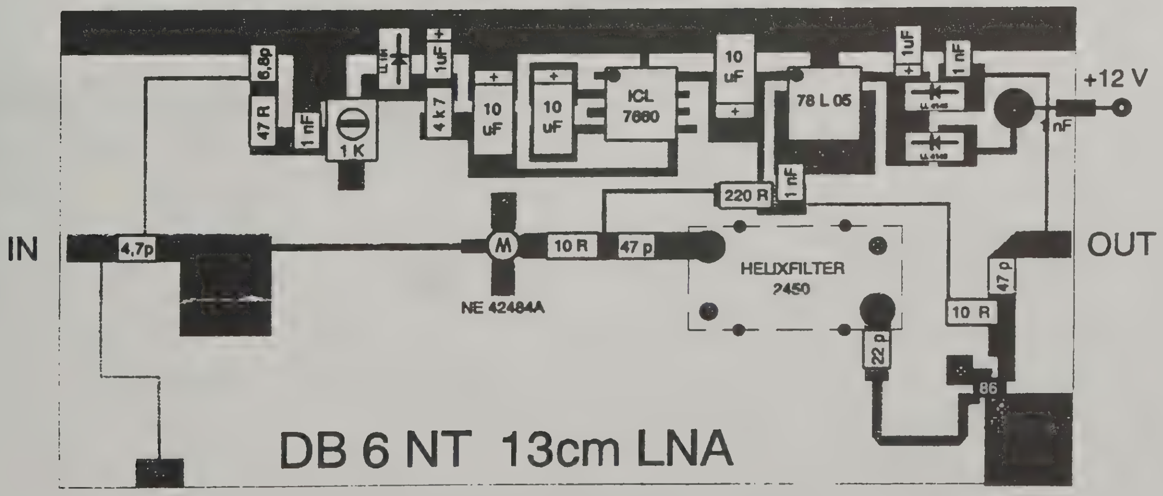
References

- Bertelsmeier, Rainer, DJ9BV, "No-Tune HEMT Preamp for 13cm," DUBUS Book 4, pgs. 191-197.
- Bertelsmeier, Rainer, DJ9BV, "PHEMT Preamp for 13cm," DUBUS Book 4, pgs. 198-207.
- Kuhne, Michael, DB6NT, "Compact 13cm Linear Transverter," DUBUS Book 4, pgs. 264-275.
- Data sheet, NE42484A, NEC.
- Data sheet, MGA 86563, HP/AVANTEK.
- Data sheet, R04003, PC Boards, Rogers.
- Data book, Helixfilter, NEOSID. ■

Parts List

Item	Specifications	Source
Tin sheet metal housing	37x74x30mm	
N-female chassis connector	small flange	
N-male chassis connector	small flange	
PC-board RO4003	(single or two stage)	Rogers
Feed-through capacitor, solder type	0.1 nF	
Trimmer pot. 1k	23B-SMD	Beckman
Helical filter 2450	7.2G	NEOSID
PHEMT-FET SMD	NE42484A	NEC
MMIC SMD*	MGA86563	HP/Avantek
IC SMD SO8	ICL7660	
IC SMD SO8	78L05	
Tantalum electrolytic (3)	10µF / 16V	"C"
Tantalum electrolytic (2)	1µF / 35V	"A"
Ceramic capacitor (3)	1nF / 50V	SMD 0805 NPO Philips
Ceramic capacitor (3)	6.8 pF	SMD 0805 NPO Philips
Ceramic capacitor (3)	4.7 pF	SMD 0805 NPO Philips
Ceramic capacitor (2)	47 pF	SMD 0805 NPO Philips
Ceramic capacitor (2)*	22 pF	SMD 0805 NPO Philips
Diode Mini MELF (2)	LL4148	
Schottky diode Mini MELF	LL101	
Resistor 1206 SMD	10Ω	
Resistor 1206 SMD	47Ω	
Resistor 1206 SMD	220Ω	
Resistor 1206 SMD	4.7Ω	

**** Denotes second stage only***



● plated throughholes

Figure 2. Printed Circuit Board Diagram for DB6NT 13cm LNA.

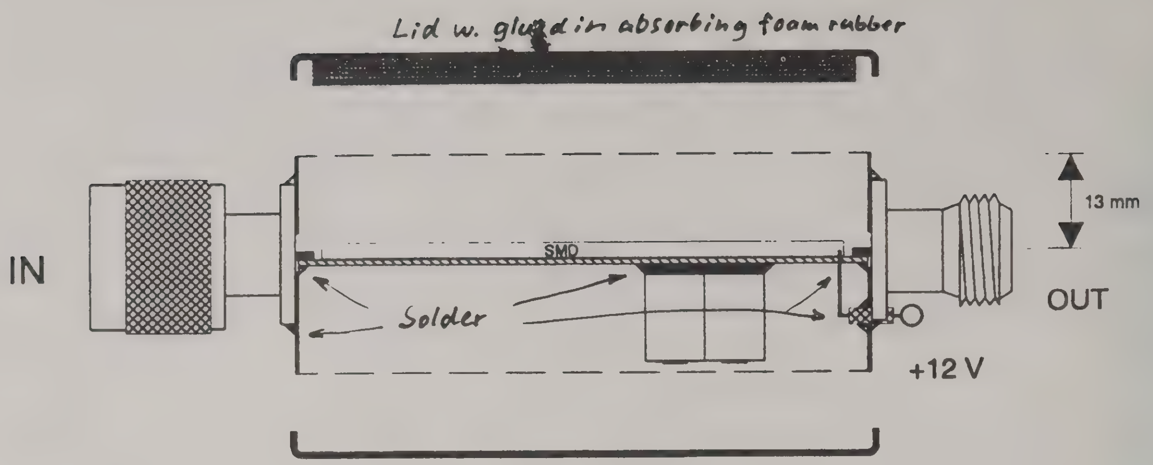


Figure 3. Metal Housing and Installation Details.

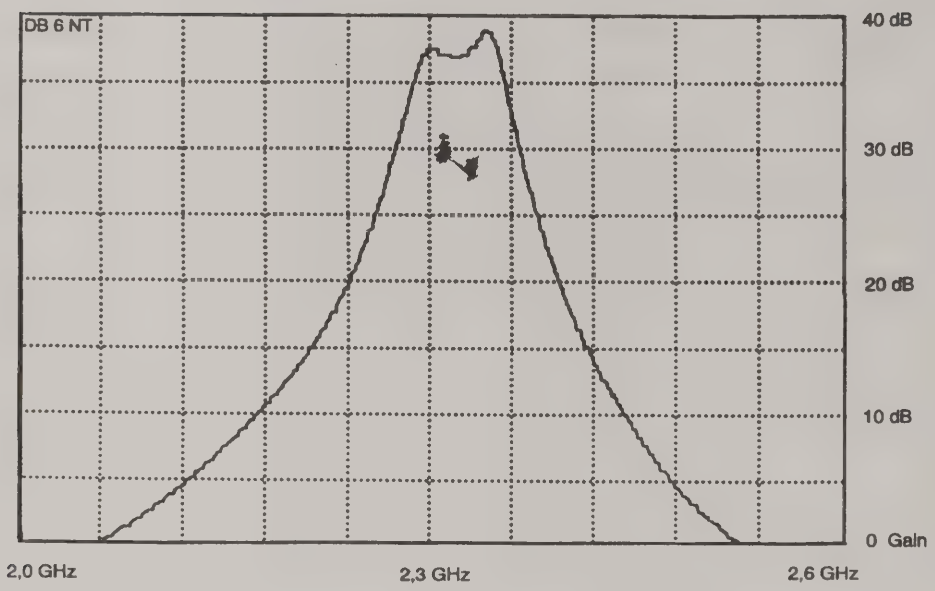


Figure 4. Helic Filter Passband Can be Tuned at Will.

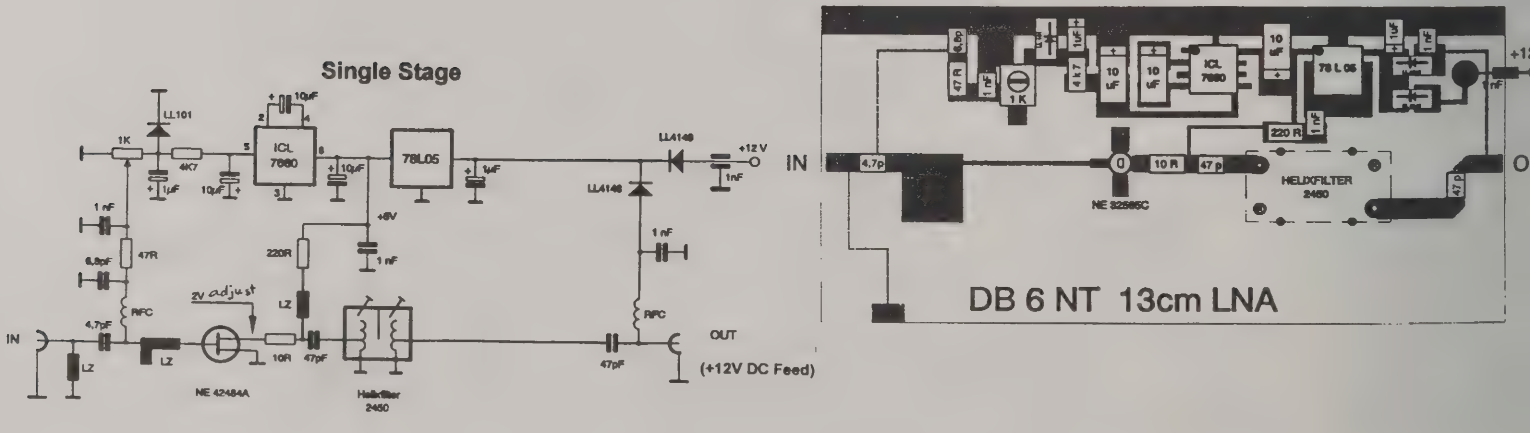


Figure 5. Circuit Digram and Printed Circuit Board of Single Stage DB6NT 13cm LNA.

Field Ops Update: Showing the Flag at Hamfests

Barry A. Baines, WD4ASW (*wd4asw@amsat.org*)

Happy New Year! It is time once again to highlight the efforts of our Area Coordinators and others who take the time to represent AMSAT at hamfests (both large and small) around the country. There is both a 'good news' and 'bad news' story. The 'good news' is that in 1999, volunteers represented AMSAT at 41 hamfests. Through the efforts of our volunteers, AMSAT collected a significant amount of revenue by offering AMSAT materials such a books, software, and trinkets as well as AMSAT memberships. Most importantly, volunteers were available to answer questions, build enthusiasm for the satellite program, and serve as resource persons to those wanting to learn more about getting started on satellites. During 1999, thousands of hamfest attendees were given the opportunity to learn more about the satellite program due to the efforts of our volunteers. Clearly, AMSAT benefited greatly from the successes of our volunteers and we gratefully acknowledge their contributions.

AMSAT will once again have representation at various hamfests, ARRL conventions, and various meetings around the country in 2000. Assuming that AMSAT will attend the same shows this year as in 1999 and based upon upcoming hamfest information provided on the ARRL website and by other sources, we project that AMSAT will be represented at the hamfests identified in Figure 1.

The 'bad news' is that there are a number of significant hamfests where AMSAT does not have a presence. Our absence is due to the need to find volunteers to represent AMSAT at these shows. Figure 2 lists specific examples of shows where AMSAT was not present last year and which perhaps we need to be represented in 2000. Of the hamfests listed in Figure 2, two of the truly significant ones are the Atlantic Division Convention in Rochester, NY and the Northwest Division Convention in Seaside, OR. Both conventions take place the first week in June. In the past we've been unable to find volunteers to do these shows. Likewise, we haven't attended Pacificon in Concord, CA in October. If you're interested in representing AMSAT at these or other hamfests, please contact Martha Saragovitz via e-mail (*martha@amsat.org*) or at the AMSAT office (301-589-6062). You can also contact me via e-mail or home phone (904-398-5185).

It is interesting to note that as of 12 January 2000, the ARRL website listed 249 hamfests and meetings of all sizes and descriptions. As noted above, AMSAT was represented at 41 hamfests in 1999. Recognizing that the ARRL website does not list every hamfest, but assuming that every hamfest that AMSAT was at in 1999 is also on the ARRL listing, at best AMSAT was at only 16% of the potential hamfests. Clearly, there are opportunities for AMSAT to establish a greater presence if we can find volunteers to represent AMSAT at more hamfests. Your assistance in helping to represent AMSAT is certainly appreciated. ■

- Southwest Ohio Digital Symposium, Middletown, OH 1/15
- Frostfest, Richmond, VA 1/16
- Winterfest, St. Charles, MO 1/22
- Miami Hamboree-Southeastern Division Convention 2/5-2/6
- Mississippi State Convention, Jackson 2/4-2/5
- Orlando Hamcation-Florida State Convention 2/12-2/13
- Splitrock ARA, Parsippany, NJ 3/4
- Charlotte-North Carolina State Convention 3/11-3/12
- Acadiana ARA, Rayne, LA 3/11-3/12
- Cherryville, NJ Repeater Association 3/18
- West Gulf Division Convention, Tulsa, OK 3/24-3/25
- Great Lakes Division Convention, Cincinnati, OH 3/25-3/26
- Maryland State Convention, Timonium 3/25-3/26
- Amateur Electronic Supply Superfest , Milwaukee 4/7-4/8
- North Carolina State Convention, Raleigh 4/9
- Louisiana State Convention, Baton Rouge 5/5-5/6
- Dayton Hamvention-ARRL National Convention 5/19-5/21
- Texas State Convention, HAMCOM, Dallas 6/9-6/10
- Delta Division Convention, Knoxville, TN 6/11
- Raritan Valley Radio Club, Dunnellen, NJ 6/17
- OH-KY-IN ARS, Cincinnati 7/22
- Arizona State Convention, Ft. Tuthill 7/28-7/30
- South Texas Section Convention, Austin 7/28-7/29
- New England Division, Boxboro, MA 8/26-8/27
- Platiumum Coast ARS, Melbourne, FL 9/9-9/10
- Greater Cincinnati ARA Expo 9/16
- Hudson Division Convention, White Plains, NY 9/16
- Roanoke Division Convention, Virginia Beach, VA 9/23-9/24
- Southwestern Division Convention, Scottsdale, AZ 10/6-10/8
- Bergen ARA, Teaneck, NJ 10/7
- AMSAT Symposium, Portland, ME 10/27-10/29
- Suncoast Convention, Tampa, FL 11/18-11/19

Note: This is a tentative listing and is subject to change depending upon our volunteers being able to attend these shows. There are also a number of smaller hamfests/meetings which AMSAT participated last year but that I don't have dates for in 2000 and so aren't listed above.

Figure 1. List of Hamfests sorted by date where AMSAT expects to be represented in 2000.

- Tennessee State Convention, Memphis 2/12-2/13
- Vermont State Convention, Milton 2/26
- Nebraska State Convention, Norfolk 3/10-3/11
- West Texas Section Convention, Midland 3/18-3/19
- Maine State Convention, Lewiston 3/24-3/25
- Southeastern VHF Conference, Atlanta, GA 4/14-4/15
- Delaware State Convention, New Castle 4/30
- Washington State Convention, Yakima 5/13-5/14
- Wyoming State Convention, Casper 5/27-5/28
- Northwestern Division Convention, Seaside, OR 6/1-6/4
- Atlantic Division Convention, Rochester, NY 6/2-6/4
- Utah State Convention, Bryce Canyon 7/7-7/9
- Georgia State Convention, Gainesville 7/8
- Montana State Convention, East Glacier 7/14-7/16
- Oklahoma State Convention, Oklahoma City 7/29-7/30
- Kansas State Convention, Salina 8/27
- Kentucky State Convention, Louisville 9/9
- Connecticut State Convention, Wallingford 10/8
- Pacificon, Concord, CA 10/20-10/22

Figure 2. List of Hamfests sorted by date where we need volunteers to represent AMSAT in 2000.

Minutes of the AMSAT Board of Director's Meeting

Held October 10 and 11, 1999 in San Diego, California

The meeting was convened by Chairman Tynan at 1:05 PM PDT on Sunday, 10 October 1999 at the Hanalei Hotel, San Diego, CA. Members of the Board of Directors (BoD) in attendance were:

- Barry Baines AD4SW - VP Field Operations
- Keith Baker KB1SF - President
- Tom Clark W3IWI - President Emeritus
- Dick Daniels W4PUJ
- Robin Haighton VE3FRH - Executive VP
- Andy MacAllister W5ACM - VP User Services
- Bill Tynan W3XO - Chairman of the Board

Others participating at various times included:

- Frank Bauer KA3HDO - VP Human Spaceflight Programs (by telephone)
- Larry Brown W7LB - Area Coordinator AZ
- Bill Burden W1BRE - VP Strategic Planning
- Art Feller W4ART - Treasurer
- Ronnie Fitch N6SHI - Area Coordinator, CA
- Mike Gilchrist KF4FDJ - Alternate BoD Member
- Chuck Green N0ADI – Phase 3D Integration Laboratory
- Lou McFadin W5DID – Phase 3D Integration Laboratory Manager
- Duane Naugle KO6BT - Area Coordinator, CA
- Jean Naugle KQ6QHT - Annual Meeting Coordinator
- Harold Price NK6K - Software Development
- Keith Pugh W5IU - VP Operations
- Martha Saragovitz - Corporate Secretary/Manager
- Dan Schultz N8FGV
- Ray Soifer W2RS - VP International Affairs (by telephone)
- Paul Williamson KB*5MU - VP Electronic Publishing*

I. Election and Appointment of Officers

New Board members Baines and Haighton and alternate Gilchrist were welcomed. Incumbents Daniels and Tynan were congratulated upon their reelection to the BoD. President Baker announced that he was willing to serve in that position for another year and Clark moved that the Board reelect Baker as President. Haighton seconded and the motion passed by unanimous vote. Baker assumed conduct of the meeting and announced that all the remaining incumbent senior officers had agreed to continue to serve for the coming year. Baker moved that they be re-elected. Tynan provided a second and they were reelected by unanimous vote. Baker asked Tynan to continue to serve as BoD Chairman and Tynan agreed. Baker so moved and Haighton seconded. Tynan was reelected with Tynan abstaining. Other officers will be appointed by the President and this does not require Board action.

II. Presentation of the Budget for 2000

Tynan again assumed the Chair and stated that as at past BoD meetings the budget for each department would be examined as their report is presented. Baker distributed copies of the budget in draft form and expressed appreciation for Treasurer Feller's excellent work on the document.

Feller announced that prior to signing the launch contract for Phase 3D satellite and assuming that no fund raising campaign is undertaken, a deficit of approximately $126,620 is projected. There was extensive discussion of the numerical details of the proposed budget. Haighton noted that expenses for the past three years have been relatively constant with relatively little spent on promotional activities in 1999. Feller stated that in the coming year with a possible Phase 3D launch and International Space Station (ISS) activity expenses can be expected to increase markedly.

It was decided that adoption of the final budget must be delayed until more information on future Phase 3D expenditures becomes available.

III. Strategic Planning for AMSAT-NA

Burden stated that the Strategic Planning Team included him, Russ Tillman, Bdale Garbee, Steve Bible, Dan James, Robin Haighton, Keith Baker and the recent addition of Mike Gilchrist.

The committee had been charged with the task of developing a Mission Statement and Plan of Action for which they used the AMSAT Articles of Incorporation as a starting point. The document they have developed represents what direction the committee believes AMSAT should be taking and the kind of organization they would like it to be five years hence. They have now developed a Mission Statement and next will generate a detailed Working Plan to achieve these goals. After discussion and inclusion of a few minor changes the BoD approved the declaration (Figure 1).

Burden announced that his committee will need to meet in person before the next BoD meeting to work toward identifying AMSAT's internal strengths and weaknesses, its external opportunities and threats and finally the key issues and challenges. Three to five long-range goal statements will be created, and for each goal a set of specific actions to achieve the goal will be suggested.

The Strategic Plan will then be presented to the BoD for approval and selection of the strategies to be undertaken.

Clark moved a resolution commending Burden and his committee for their efforts to date, and noting that the BoD is in strong general agreement with the points that were made and wants to see them proceed to the next step. Daniels seconded and the motion passed unanimously.

IV. Phase 3D Progress Report

McFadin described progress being made toward preparing the spacecraft for final checks, shipping and launch. He said there are no known discrepancies and that the shipping container presently on hand will be satisfactory for the trip. Phase 3D is to be trucked to Miami, placed on an aircraft for a flight via Paris to Cayenne and then taken by truck to Kourou. Clark moved that the existing insurance coverage of Phase 3D be continued. Daniels provided the second. Feller recommended that this be expressed as the Sense of the Board rather than a binding motion. A consensus was thus achieved. It was noted that the shipping cost of $20,000 includes passage for two persons to accompany Phase 3D. McFadin suggested that an inspection of the spacecraft be made after the flight to Cayenne and again after the road trip to the launch site. This infers that the spacecraft would not be transferred to AMSAT-DL custody until this inspection is complete. McFadin suggested planning for a shipping date around mid-November.

The Board then went into closed session to discuss Phase 3D lab, personnel and accounting issues.

V. Operations Report

Pugh noted that it had been a quiet year for Operations. The year was marked by the successful sharing of AO-16 with APRS packet operators who are now also considering use of IO-26 and LO-19 for their operations. QRM from 2 meter terrestrial activity has been reported on FO-20 but this is not a recent happening and FO-20 is not an AMSAT-NA satellite.

Figure 1.

AMSAT-NA Mission Statement

AMSAT-NA is the principal North American Amateur Radio organization supporting the development of skills and specialized knowledge in the art and practice of Amateur Radio communications, as well as technology and science in space. We develop, build and operate satellite systems for Amateur Radio communications and experiments using Amateur Radio stations throughout the world.

Value Statement

We recognize our responsibility to:

- *be a steward of radio spectrum,*
- *encourage experimentation,*
- *share information and help others,*
- *engage in education and training, and*
- *exercise prudent fiscal management.*

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Clark recommended reinstating Wednesdays as Experimenter's Day on AO-16 and suggested that this schedule be adopted in those countries also operating amateur satellites. He made the following motion: "To foster experimentation using the Amateur Radio satellites, AMSAT encourages the notion that for the LEO satellites, Wednesdays be earmarked as Experimenter's Day". Baker seconded and the motion passed by unanimous vote.

Pugh encouraged the continuation of AMSAT HF nets and stated that the 20 meter net continues to have 15-20 stations checking in each week. He also recommended that we continue to have a presence on 75 meters. He stated that band conditions on 15 meters are not yet good enough to reestablish a net on that band. An extensive discussion followed and it was decided that a notice should appear in *The AMSAT Journal* reminding everyone of the various AMSAT nets. Clark asked if the Internet hasn't replaced the need for the nets. Pugh opined that because the nets were a social event allowing a rapid interchange of ideas and that they have had welcomed occasional drop-ins and just listeners who were interested to hear about satellite operation. Clark asked about the Houston Net which uses the Internet and a commercial satellite transponder to achieve nationwide coverage. Pugh pointed out that there are still hams who do not have Internet service and that local VHF nets have limited coverage. Tynan suggested finding a station in middle America with high power capability to manage the 75 meter Mid-continent Net. Pugh said that he would investigate the possibility of using the facilities at the Lockheed ARC.

VI. The AMSAT Journal and Other Publications

Baines read the text of Journal Editor/VP Publications Russ Tillman's report describing accomplishments in 1999 and plans for the coming year.

A. Publications:

- Private Vendor Consignment: ARRL staff have been informally contacted to discuss plans for allowing them to make AMSAT publications available on consignment. Initial discussions with ARRL have been very promising and it appears that this outlet could greatly enhance AMSAT's visibility as well as distribution of publications with associated revenue. It was concluded that additional procedural details need to be worked out at our level before a Memorandum of Agreement can be prepared for formal ARRL and AMSAT approval.
- AMSAT-ZL CD ROM: With the approval of AMSAT-ZL and with the help of AMSAT member Terry Douds, we were able to cost-effectively reproduce AMSAT-ZL's CD ROM about Amateur Radio satellites. We envision this project as a pilot test for a larger scale development and production of an AMSAT-NA CD ROM hat would include back issues of *Orbits* and *The AMSAT Journal* as well as software, data, documentation, information and photos of Phase 3D and other satellite developments. This pilot effort has not only measured membership demand for such a product but has also tested the ability of our volunteer infrastructure to undertake such a project. Several members have been identified who might successfully take on an AMSAT-NA CD ROM venture.
- AMSAT Bibliography: It is also planned to assemble and make available a bibliography of Amateur Radio satellite publications. Hopefully, this bibliography will be a continually growing document that will be a helpful source in supporting AMSAT's future efforts.

B. *The AMSAT Journal*:

- Tillman's report noted that our ability to obtain articles in a timely manner for the Journal continues to go very well except for one area: obtaining timely information and articles on university-developed Amateur Radio satellites. For some reason, it has been very difficult to get information regarding such projects and obtain timely articles about them. Our major source of information about these endeavors (and others) continues to be AMSAT-BB and other Internet sources. However, we have not had much success in getting the builders to submit articles, or even to provide information so that we can ghost-write articles for the Journal.
- It is suggested that AMSAT develop a strategy to play a more pro-active role in mentoring and supporting university projects. It is assumed that this interaction would not only better serve the Journal needs in getting pre-launch information out about these project, but would also enhance the operational value for radio amateurs.
- Tillman's report emphasized that he remains ready to publish a special issue of *The AMSAT Journal* to commemorate the launch of Phase 3D. The plan for publishing this issue remains the same and no problems in producing the issue are anticipated.

C. Acknowledgements:

Tillman's report emphasized that publishing the Journal has not been a one-person effort. He particularly cited the assistance of Martha Saragovitz, Ron Long, Bill Hook, Andy Reynolds, John Bubbers and Buzz Gorsky. He said that their efforts and continued support are to be commended.

Tillman ended by saying that this has been a very busy year for his family. Nevertheless he remains devoted to AMSAT and looks forward to this spring when he can expand and accomplish the above mentioned Journal and publication plans.

Haighton moved that Tillman's report be accepted with thanks and commended Tillman and his crew for their efforts. Baker seconded and the motion was passed by a unanimous vote.

Saragovitz said that the announcement of the availiability of the AMSAT-ZL Satellite Compendium on CD ROM that appeared in the August/September issue of *The AMSAT Journa*l resulted in about 20 orders. Clark suggested that a detailed bibliography of all AMSAT publications appear on our Web page.

VII. Field Operations Report

Baines began his report by outlining accomplishments of the Field Operations Department in 1999. He characterized the past year as "relatively quiet", but said that much had been achieved.

He began by saying that it is planned to hold another Satellite Workshop in 2000.

He then summarized the Field Organization Activities as including the following:

- Representing AMSAT at hamfests
- Conducting local area nets
- Serving as Elmers
- Encouraging satellite activities at schools, hospitals and Field Day

He reported that the number of Area Coordinators was constant in 1999 with 152 in the US and Canada plus 3 "Country Representatives".

- A Field Ops Update with a listing of the Area Coordinators is published each year in the March/April issue of *The AMSAT Journal*.
- The AMSAT office has the latest list available for distribution to new members.
- This list is also available on the AMSAT Web site but may not be as up-to-date as other sources. A discussion ensued regarding how the list can be effectively updated on the AMSAT Web page.

As of 23 September 1999, Area Coordinators represented AMSAT at 36 hamfests around the US and Canada.

Baines further reported that as of 31 August 1999, collections by volunteers of donations from books, software, trinkets, etc. are estimated at over $10,350 (gross income).

He said that presentation materials currently being made available to Area Coordinators include:

- *The Beginner's Presentation,* (updated by Roy Welch for QCWA)
- *Working the Easy Sats,* updated by Mike Seguin
- *A Resources Guide*, updated by Mike Seguin

Other Materials:

- The *1999 AMSAT Satellite Frequency Chart* was updated by Bill Tynan W3XO with help from WD4ASW, KA3HDO, N2WWD, NN0DJ, WD9IYT, 4X4AS and G7UPN.
- An addendum to *How to Use the Amateur Radio Satellites* was developed by Keith Baker.

Field Ops Breakfast:

An Area Coordinators Tool Kit (on floppy disk) containing materials for presentations at meetings and hamfests was distributed at the morning's Field Ops Breakfast.

Baines asked the Board to recommend candidates to serve as new Area Coordinators. Feller requested that Baines recapitulate for the current Field Ops volunteers his piece describing how AMSAT offers items in return for donations. He noted that if we accept free-will donations this is not considered a sale. A discussion of tax matters followed. Baines said he is looking forward to assembling a larger version of the Tool Kit on CD ROM for the Area Coordinators and others needing material for presentations.

Baines asked for assistance with this project stating that he must frequently update the list of Area Coordinators.

Baker stated that at some hamfests the volunteers have reported running out of materials and he suggested sending larger quantities. Saragovitz replied that in some cases software items have not been received at the office in quantity or in time to ship to a hamfest. She stated that the usual situation was that many items were returned from hamfests. Haighton commented that in Canada he frequently retains items to take from one hamfest to another and Saragovitz stated that this is sometimes also done in the USA.

Clark asked Baines to poll the Area Coordinators to obtain their suggestions about issues involving the user community.

The President declared a commendation to Baines for his excellent work.

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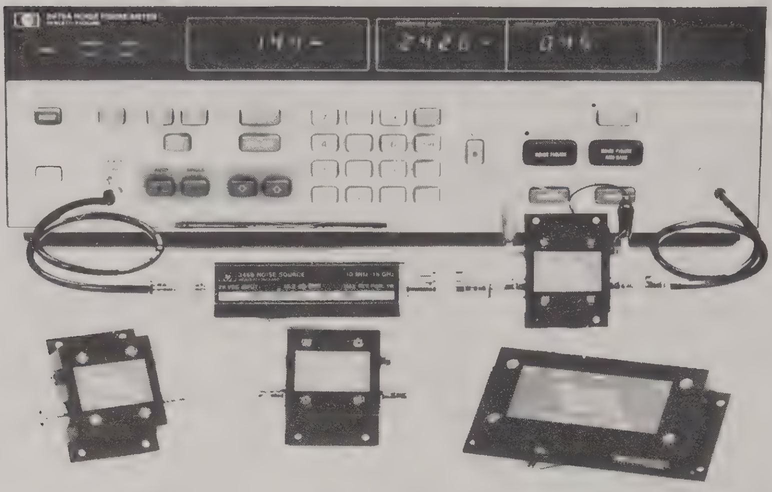

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P220VDA	220-225	<1.2	15	0	DGFET	$37.95
P220VDG	220-225	<0.5	20	+12	GaAsFET	$79.95
P432VD	420-450	<1.8	15	–20	Bipolar	$32.95
P432VDA	420-450	<1.1	17	–20	Bipolar	$49.95
P432VDG	420-450	<0.5	16	+12	GaAsFET	$79.95
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SP50VD	50-54	<1.4	15	0	DGFET	$59.95
SP50VDG	50-54	<0.55	24	+12	GaAsFET	$109.95
SP144VD	144-148	<1.6	15	0	DGFET	$59.95
SP144VDA	144-148	<1.1	15	0	DGFET	$67.95
SP144VDG	144-148	<0.55	24	+12	GaAsFET	$109.95
SP220VD	220-225	<1.9	15	0	DGFET	$59.95
SP220VDA	220-225	<1.3	15	0	DGFET	$67.95
SP220VDG	220-225	<0.55	20	+12	GaAsFET	$109.95
SP432VD	420-450	<1.9	15	–20	Bipolar	$62.95
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VIII. Executive Session

At this point the meeting went into a closed session to deal with administrative matters including Saragovitz's performance review and compensation. While no record was made of this session it was subsequently mentioned that Martha will be granted an increase in pay as a result of continuing good performance and in recognition of an increase in the cost of living.

IX. AMSAT Internet Facility

Tynan stated that the facility seems to be running well but added that he'd like the Amateur Satellite Guidelines be made more easily accessible on the Web site. He opined that its placement among Frequently Asked Questions was not optimal. Baker commented that the rearrangement of topics alphabetically was a tremendous help and makes it easier to find these Guidelines.

Feller opined that the AMSAT site might be divided into two parts, e.g., Operating Information and Mission Planning and that the guidelines should be a part of the latter.

Saragovitz noted that she had asked VP Williamson to make it clearer as to how to contact the business office.

Noting that recent techniques have been developed to make Web sites come more "alive" and make it possible to display information in a three-dimensional format, Clark suggested encouraging Web page artists to participate in the evolution of AMSAT's pages. Williamson agreed that AMSAT's site was relatively plain but that it's one of the fastest loading sites on the Internet and opined that it's attractive enough and maybe glitz isn't necessary. Baker noted that the site had been spruced up recently and thought that it looks good.

Williamson stated that over 11,000 persons are utilizing the amsat.org alias list.

It was noted that an individual in Virginia, not affiliated with AMSAT-NA, has registered the Internet domains amsat.com and amsat.net. It was the sense of the Board that AMSAT-NA should:

- Take steps to recover the amsat.com and amsat.net registrations,
- Register amsat.edu
- Form a group of interested members to consider registration of other amsat domains to protect against the threat of cybersquatters.

It was later concluded that an .edu domain is available only to accredited educational institutions. So, we will not be able to get that designation.

Clark suggested registering amsat.ca in Canada. Williamson opined that you can go broke doing this sort of thing and suggested that there was little reason to register amsat.ca and recommended just going after amsat.com for possible future use in the commercial arena. Haighton asked if the amsat domain was registered in Canada and Feller replied "no". Haighton then recommended registering the amsat.ca domain as well as the AMSAT trademark in Canada and said that he will look into both of these. A letter will be written to Network Solutions advising them of our registration of the AMSAT trademark.

The question arose whether we should apply for the AMSAT-NA trademark to complement our present registration of AMSAT.

Williamson was asked to include with HTML coding the list of Area Coordinators on the Web site so that one could click on a state and get a current list of the relevant volunteers. The intricacies of doing this were discussed. Clark asked if funding should be allocated now for upgrading the BBS, e.g., with faster CPUs in view of a possible large increase in activity in year 2000? Williamson replied that there has been a provision for this in his budget for the past five years so it's probably not necessary now and if a need arises the required purchases could be made and installed within a day or so.

Tynan noted that there is $2600 presently allocated in the budget for this and Williamson replied that this was more than sufficient to replace the entire system. Thus the present budget is adequate.

Tynan commended Williamson for his continuing yeoman service and noted the improvements that have been made on our Web site.

Clark concurred and said he hoped that Williamson would continue his good work. Clark also acknowledged the contributions of Brian Kantor of USC who has provided the physical hosting on UNIX machines of the AMSAT e-mail functions. Baker agreed to continue to consult with Williamson on projects involving the Internet facility.

X. AMSAT Involvement with the MOST Satellite Project

Haighton distributed the report received from the Microvariability and Oscillations of STars (MOST) Project Manager Dr. Robert Zee of the University of Toronto Institute for Aerospace Studies (UTIAS). MOST is currently in the detailed design phase with a critical design review scheduled at the end of February 2000. In mid-January it is intended to hold internal design review meetings with the core AMSAT team. The current major thrust is on building engineering models of all the electronics to demonstrate as close as possible the final satellite configuration. The following AMSAT-NA members have recently been involved as mentors; Harold Price, Lyle Johnson, Bdale Garbee, Chuck Green, Mark Kanawati, Dino Lorenzini, Jim White, Dick Jansson, and Jan King.

XI. LEAST (AMSAT Package on MOST)

Haighton gave the background of the MOST agreement that includes an Amateur Radio package provided by AMSAT-NA. This opportunity was announced on the Internet along with a request for proposals. Several replies were received from worldwide sources including France, Hungary and the USA. The most promising among these was a package to be known as LEAST (Lots of Extra Amateur Stuff on the Telescope) A discussion followed including how to budget the project. Clark recommended getting more details before a specific dollar amount is approved for AMSAT's participation.

Price then reviewed AMSAT's consulting role for the MOST project and the plan to provide the LEAST Amateur Radio payload that will accompany MOST in flight. He stated that the Amateur Radio project has been in a state of flux awaiting details of what the mass and volume limits will be. Much of this information is now known so there is a good idea of what the actual constraints are. The remaining piece of information yet to be provided is the space to be available for antennas. The specific plan for LEAST calls for an L band uplink, an S band downlink, a CPU board and a 50 MHz to 2 GHz general coverage receiver with its own antenna. The major constraint now is what will the antenna look like, how to get it broad banded and yet not protrude above the body of the spacecraft in a way that will not conflict with MOST's optical performance? Price said he hopes to consult with Clark about the antenna's design. The power budget is 5 watts DC, the mass 2 kg and the space available is 8.5 x 11 x 1 inches.

The team will now proceed to the next stage of design after which they can provide the BoD with more exact details of what LEAST is, does and will cost. These details will be submitted to the AMSAT BoD for discussion and an agreement that work should proceed. Saragovitz asked about the time frame and Price answered that because the MOST project timetable is presently in a state of change and MOST is as yet without a launch commitment, this is uncertain. He added that Dr. Zee of UTIAS has stated that they have funding and employees working to complete the MOST spacecraft. Delivery of the LEAST package will likely be due by end of summer 2000. Saragovitz stated that there was no provision in AMSAT's budget for LEAST in 2000. Tynan agreed and said that it would be necessary to revise the budget to accommodate this. Price opined that $30,000 to $40,000 would likely be an appropriate amount to budget explaining that LEAST was just a module. It was agreed that the LEAST project should be included in a fundraising letter to be prepared in November.

A motion was made by Haighton that AMSAT-NA support in principal the LEAST project with the understanding that a more detailed statement of financial outlay would be received by November 30, 1999. This was seconded by Clark and the motion passed by unanimous vote.

Haighton agreed to advise the LEAST group of the need to provide more detailed financial information.

XII. International and IARU Matters

Soifer reported by telephone that the past year has been both interesting and eventful on the international front. Below are listed some of these happenings.

The IARU Administrative Council at its meeting in Lillehammer, Norway adopted an Information Paper for prospective owners and operators of satellites intended for operation in the Amateur Satellite Service. This is based upon AMSAT-NA's Guidelines document that was approved by the BoD in 1996 and by the IARU International Satellite Forum in 1997. The recently approved IARU version includes minor updating and revisions added by Dave Sumner that do not affect the substance of the paper. This document has been posted on the IARU's Web site. The principles outlined thus represent the views of international Amateur Radio in general as well as amateur satellite enthusiasts. The IARU has requested that AMSAT organizations with Web sites link to theirs for dissemination of this and other documents of interest to our users. Williamson reported that this has already been done.

Contributing to the impetus behind the ARRL and IARU approving such a document was the Swatch Watch "Beatnik" satellite episode earlier this year. Through the work of several persons, this incident was brought to a successful conclusion when the satellite was deployed from *Mir* in the "off" condition and Swatch carried out its promotional campaign over its Web site instead of via Amateur Radio. AMSAT-NA, ARRL, IARU and AMSAT- France, AMSAT-DL and AMSAT-Russia and other organizations., as well as a number of individuals contributed to this result.

Graham Ratcliff was re-appointed as IARU AMSAT Frequency Coordinator for 1999-2000. Thanks and congratulations were extended to Graham for his fine work in this area.

The AMSAT-International Internet distribution completed another year of faithful service. At last count, 26 AMSAT organizations were represented in addition to IARU and another, AMSAT-Venezuela, is in the process of organization. Thanks were extended to Williamson for helping to keep AMSAT-International going.

In the "bad news" department, the IARU Region 1 Conference in Lillehammer did not extend the use of 144.49 MHz as an uplink frequency for ISS. The 1999 IARU International Satellite Forum held on October 8 in San Diego recommended that efforts be continued to work out a permanent solution, but recognized that 144.49 MHz must be continued on an interim basis to keep ARISS on track. Soifer expressed concern that if the problem wasn't resolved in Region 1, then AMSAT should have an alternate plan available. The consensus was to continue to plan to use 144.49 MHz.

Also in the "bad news" category is that pressure is growing on the amateur 70 cm band, including our satellite sub-band at 435-438 MHz. Amateur use of this band has been withdrawn in Hong Kong and amateurs in Guatemala still do not have the use of it. Similar frequency auctions are planned in Honduras and in Europe pressure is growing to restrict amateurs to 432-438 instead of 430-440 MHz.

In the 144 MHz band, interference from non-amateur users is rampant in Asia as well as parts of Central America and Spain, (e.g., the infamous "Spanish taxis" on 145.85 MHz). Some of this has also been noted in the USA. However, this interference is a different matter than that at 70 cm because it is not government-sponsored and has resulted primarily from weak or nonexistent enforcement by national

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administrations. The Forum recommended that interference reports be referred to our national IARU societies for possible action.

Soifer stated his view that it is extremely important to the future of the Amateur Satellite Service that satellite interests be well represented at the IARU regional level, both at regional conferences and on standing VHF/UHF committees where these exist (e.g., Region 1). This representation should be done by residents of the region involved, with the active cooperation of the IARU regional officers and member societies.

The next IARU International Satellite Forum will be held at the University of Surrey in July 2000. Soifer stated that he expects to attend on behalf of AMSAT-NA. He thanked the officers and BoD members for their help during the year.

Tynan stated that the total amount budgeted for the International Affairs department is $2400 and Soifer agreed that this is satisfactory. He made the suggestion that, now that IARU has adopted in essence AMSAT's guidelines defining Amateur Radio Satellites, that in the interest of avoiding confusion we replace AMSAT's recommendations with those of the IARU. Tynan restated this by stating that our guidelines are no longer needed because they have been supplanted by IARU guidelines that are fully in accord with AMSAT's guidelines. Daniels moved that as soon as the guidelines are available on the IARU Web site in text form, that the AMSAT document will be superseded by IARU's. Haighton seconded and the motion passed by unanimous vote.

With regard to the situation involving non-amateur use of our 70 cm band, Tynan stated that this is viewed with alarm, citing potential interference to Mode B operation, and asked what action should AMSAT take? Feller suggested writing a letter to ARRL expressing our concerns relating to Phase 3D and asking them to notify the IARU and the U.S. Administration. Clark moved that such a letter be written, Haighton seconded and it was approved by unanimous vote. Feller was asked to draft the letter in appropriate language for Baker's signature. Haighton asked that a copy be prepared for his signature to be sent to Radio Amateurs of Canada (RAC). It was then decided that Feller, Baker and Haighton will prepare the letter.

Tynan noted that an increasing number of countries are approving amateur operation in the 6 meter band and he suggested that this would be a good band to have space allocated for amateur satellite use. He asked for the sense of the Board toward providing AMSAT's support for making a part of the 6 meter amateur band available worldwide. Tynan asked that AMSAT approach ARRL, and possibly RAC, and thus IARU to request that relevant administrations if support can be gained to make the 6 meter subject an item to discuss at a future World Radio Conference (WRC). He noted that lower frequencies like 6 meters exhibit less Doppler effect on signals and would be highly useful for use by the Amateur Radio on the International Space Station (ARISS) project.

Soifer said that in discussions with Robert Jones of ITU, it was recommended that each AMSAT organization work with its member society to get its national administration to propose a 6 meter Amateur Satellite Service allocation.

Feller opined that a world-wide allocation for 6 meter satellite operation is needed and that applying for uplink privileges only would be an effective approach. Soifer recommended that AMSAT government affairs officers Klein and Haighton follow up with ARRL and RAC respectively. Tynan moved that it is the sense of the Board that AMSAT-NA desires an appropriate allocation to the Amateur Satellite Service in the 50 MHz band as to be negotiated internationally, and asks ARRL's support in approaching the IARU and US Government to achieve this goal. Clark seconded the motion and Tynan agreed to write the letter. The motion was approved by unanimous vote.

XIII. Auditor's Report

Treasurer Feller distributed the audited Financial Statement and Management Letter for 1998 prepared by the firm of Verkouteren, Auerbach, Olsen and Co. Clark moved that the audit be approved as written, Haighton seconded and the motion passed with none opposed. Feller said that the accounting firm had done well for us and recommended a motion that they be retained for another year. Clark so moved and Haighton seconded. The motion was passed by unanimous vote.

Feller announced that in order to keep the books in good order and to close them in an orderly fashion AMSAT's reimbursement policy is amended so as to require that all requests be submitted by the end of February of the following year. Requests should clearly indicate the date of the activity, amount, purpose and name of project for which the reimbursement is sought.

A discussion followed with respect to paying the expenses of Alternate Board Members to BoD meetings.

"Baker moved and Haighton seconded a motion that reimbursement of First Alternate Director be covered for future BoD meetings." The motion passed unanimously.

XV. Kenwood Scholarship Proposal

Baker announced that Paul Middleton of Kenwood has made preliminary overtures suggesting that Kenwood might be willing to establish a scholarship for young hams. A figure of $1000 per year for up to 4 years was mentioned. Clark suggested that the Washington, DC-based Foundation for Amateur Radio might be a suitable agency for administration of such a scholarship. Tynan asked if this would be a Kenwood activity in which AMSAT would have an advisory role in selecting candidates? The reply was that it's called a Kenwood Scholarship with no mention of AMSAT in the name. Baines asked if this was still in an exploratory phase? It was declared that the BoD was not entirely comfortable with lending AMSAT's name to a commercial interest although the concept of what they are doing is strongly supported. Haighton asked that Baker speak with Middleton to come up with a final proposal to present to the BoD. Baker asked that a committee be formed to look at the entire subject of scholarships with an eye toward where the resources might come from and the criteria to be established. He suggested that Gilchrist participate in this activity. It was noted that the BoD has previously developed guidelines for its dealings with commercial firms.

It was mentioned Kenwood has also offered to package AMSAT membership application forms with radios destined for customers in North America. Haighton moved that the offer be accepted, Clark seconded and the motion passed by unanimous vote. Baker said that he will advise Kenwood of this approval and he hoped that other manufactures will follow suit.

XVI. Amateur Radio on the International Space Station (ARISS)

Bauer presented his report by telephone. He noted that a detailed report had just been presented at the AMSAT Annual Meeting and he then mentioned some recent happenings. These included delivery of hardware to Kennedy Flight Center to fly on STS-101, negotiations are underway with Italian partners for the development of certain antennas and McFadin has delivered all the antenna systems to be provided by AMSAT-NA. Much work is yet required to get the hardware flight qualified. The next big project is to develop the Express Pallet including the completion of relevant Requests for Proposals.

Bauer noted that things are extremely busy but going well. Frequency matters were discussed at the recent IARU meeting. John and Karen Nickle are becoming involved in supporting ARISS activities and they are expected to become key players in the year ahead. Tynan noted that the budget allocated for support of the ARISS project is $27,050. Bauer agreed that this is a reasonable amount. Tynan opined, as at previous meetings, that revenue needs to be generated by this department, e.g., by the production of books and other materials. Bauer thought that a CD ROM containing ARISS material including photos and audio clips from different shuttle missions might make a good fundraising item. Clark agreed that producing such a CD was a good idea and Baker suggested that for the upcoming fund raising drive a letter with boxes to check to designate the contribution to be applied to Phase 3D, ARISS or the LEAST project. Daniels recommended that a fundraising letter not include such boxes. Rather, he said the letter should describe the projects needing funding and then let the BoD decide how best to distribute the funds. Tynan strongly agreed. It was generally agreed that this is the approach that will be taken.

Bauer said that the ARISS team is working with Energia in Russia to get the best Amateur Radio station on board the ISS as is possible. Future modes will probably include SSTV. We need, he said, to be careful to make certain that hardware development is done in the proper manner and the proper way is to subject what is to be flown to the scrutiny of the ARISS International Partners.

He emphasized that for some time, only shuttle flights will be used to fly hardware to the space station and said that Ron Parise is helping with the negotiations including what can and can't be sent up to ISS.

Clark thanked McFadin for his contributions to hardware development and complimented Bauer for his wise choice of Will Marchant as Manager of this effort. In addition to those mentioned above, others contributing to the ARISS project were awarded "Atta-boys", including Dave Larsen and Jeff Embry.

XVII. 1999 Budget and Other Financial Matters

It was decided, because of questions regarding future Phase 3D expenditures and the need for a better definition of LEAST spending requirements, not to approve the budget at this meeting. After meetings with Dr. Meinzer concerning Phase 3D costs and after the LEAST situation is clarified, the Board will meet by telephone to handle the budget.. Baker asked that BoD alternate Gilchrist be included in these discussions.

Clark recommended modernizing the process that AMSAT presently uses to distribute software and registration numbers. He suggested contracting with a service company to receive orders via the Internet. The advisability of this action was discussed and Baker suggested working with Williamson to explore the idea. Saragovitz expressed concern about the plan and Clark stressed that on-line ordering would augment but not replace the present mail and telephone ordering arrangement. Clark moved that AMSAT start adopting procedures for e-commerce using the Internet, especially as it applies to software. Williamson stated that this would be trading convenience for money. Saragovitz said it could only be used for WiSP, The

Station and InstantTrack upgrades but not for Nova. She added that little software is presently being shipped because the majority of members already have tracking and related programs. Clark's motion died for a lack of a second.

At this point, Baines and Daniels left the meeting.

Various discussions regarding AMSAT's financial outlook led to consideration of a substantial dues increase. Considered were the present decline in the number of members, increasing postage costs and the impact of a Phase 3D launch opportunity. Feller pointed out that although our dues haven't changed in 12 years the value of currency has declined and we should compensate for this and look ahead to further changes. Baker agreed, stating that the increase should be a substantial one but suggested that members be encouraged to renew now in advance at the present rate. He said that any dues increase will only recover costs and we cannot plan on the optimistic assumption that Phase 3D will soon be in orbit with a concomitant increase in membership. Tynan stated that while revenues will increase if more members are enrolled, projects like MOST are likely to be the major source of funds for technical projects.

Baker suggested making a dues increase effective at the end of 1999, but the prevailing opinion was that this would be too soon. Williamson suggested waiting until the Strategic Plan is published so members will know where the organization is going. Saragovitz cited the new projects presently underway including LEAST and ARISS and suggested waiting until after the launch of Phase 3D. Tynan suggested that 01 July 2000 be chosen as the time to increase dues, noting that even if Phase 3D is launched successfully it will not be immediately available for regular use.

Feller stated that AMSAT now loses a little money on each new membership transaction and we need to increase income significantly. Haighton opined that if dues are increased now there will be a significant number of persons who will not renew. Various possible rate and time schedules were discussed including the requirement that Life Member dues must be 20 times the yearly domestic dues and the disparity in rates for mailing the Journal to foreign addresses. While there was some disagreement as to the best course to follow, Haighton moved that members should have an opportunity to renew in advance for 2 or 3 years at the present rate. It was decided that this should be 3 years. After more discussion, it was proposed that membership dues for domestic addressees shall be $45 for one year, $42 per year ($84) for 2 years and $39 per year ($117) for a 3 year membership. Life member dues would be 20 times the $39 rate ($780). The motion was seconded and passed unanimously with Daniels and Baines absent, having left the meeting.

Haighton commented that he had been told repeatedly at the Annual Meeting that the value received relative to the registration fee was an "absolute gift" and that the program and events there approached the quality of a professional meeting costing much more. He suggested that the registration fee be made to reflect the break-even costs. Saragovitz said that the annual Financial Report will provide the information about gains or losses from the meeting. Tynan opined that most AMSAT members are not aware of present costs to attend professional meetings and, that although the AMSAT meeting may approach professional quality, he did not think hams would pay much more than they do now.

Haighton recommended raising the registration fee to $40, Duane Naugle agreed and Pugh stated that we will just lose some of the local attendees.

XVIII. Miscellaneous Items

Planning for the 2000 Annual Meeting in Portland, Maine is underway and it was noted that because of its good airport facilities and the fall tourist attractions available a sizeable turnout is expected. Suggestions were made for a site to be chosen for the year 2001. Possibilities suggested include Charlotte, North Carolina; Knoxville, Tennessee; Atlanta, Georgia; and Houston or Dallas/Fort Worth, Texas. In 2002 plans will be made for a site in the Midwestern US and for Canada in 2003. Haighton suggested that Vancouver be chosen as the Canadian site.

Gilchrist announced that he and Ken Ernandes are planning to develop a curriculum for those who ask "How do I learn to work an amateur satellite?" They have decided to create a Certification System based on an individual exhibiting various levels of expertise. These include the Satellite Communicator for those achieving 80% or more correct answers from a question pool and having received QSLs confirming satellite contacts. Next, there would be the Advanced Satellite Communicator level for those passing an exam covering types of orbits, expanded tracking techniques, station automation, decoding telemetry and satellite packet operation. The highest level of certification would be a certificate in Control Operations. Those having demonstrated knowledge of this topic would provide a needed pool of satellite controllers. It is planned to have textbooks, educational videos and an interactive CD ROM available from the AMSAT office for use as study materials. Feller suggested making available a reasonably priced Teacher's Guide for use in schools. Clark noted that in the past there was the Talcott Mountain Science Center's Space Science Involvement curriculum supplement for use in schools and that Marty Davidoff's The Radio Amateur's Satellite Handbook would be a good text for use in this program. Clark also said that study guides for students in grades K-12 have been available.

XIX. "Atta-boys" and "Atta-girls"

The following persons in addition to those mentioned in the text above were recognized for their contributions to AMSAT:

- Jean and Duane Naugle for their excellent hosting of the 1999 Annual Meeting,
- Qualcomm and Kenwood Communications, the two major corporate sponsors of the 1999 Annual Meeting,
- George and Caroline Caswell for agreeing to host the meeting in Maine next year,
- Bob Twiggs and the students at Stanford University for designing the innovative OPAL satellite that carries as its major payload a launcher that allows ejection of small satellites into orbit. They have defined its first two Amateur Radio payloads, the Santa Clara satellite and Stensat.
- Bruce Paige for his work simulcasting and Web reporting of the 17th Space Symposium and AMSAT Annual Meeting.
- Steve Bible and his team that includes Jan King, Bob Twiggs and Dwane Hansen for the Satellite Workshops and other educational efforts,
- Steve Horan for superb assistance.
- Assi Freeman of Arizona State University for developing the interesting ASUSat project,
- Bob Carpenter and Bill Hook for their help in the AMSAT office, and Bill Hook for transcribing the tapes of Board meetings.
- Jim Benson for being our banquet speaker and also for hosting us at Space Dev.
- Jeff Euing for all is good help.
- Danny Hutton as AMSAT Area Coordinator, Ontario, Canada.
- Keith Baker, last but not least, for giving AMSAT a good year.

XX. Adjournment

The Chairman declared the meeting adjourned at approximately 2:00 PM PDT on Monday, 11 October 1999. The Board will reconvene by teleconference to review the Phase 3D situation, the budget and other matters.

Note: The Board held a teleconference on 09 November 1999 with the following Board members present:

- Bill Tynan Chairman
- Keith Baker
- Robin Haighton
- Tom Clark
- Dick Daniels
- Barry Baines
- Andy MacAllister

In addition, the following participated:

- Martha Saragovitz, Corporate Secretary
- Art Feller Treasurer

This meeting was called for the purpose of reviewing the decision reached at the 10-11 October 1999 Board meeting regarding the dues increase and to establish dues for members located outside the U.S.

It was apparent that all those present felt that the dues increase voted at the 10-11October 1999 Board meeting was excessive and should be reconsidered.

After some discussion, it was moved by Clark and seconded by Haighton that the previous dues increase be rescinded and replaced with the following dues structure:

- U.S. $36 per year
- Canada $41 per year
- All others $45

The motion was passed and these new dues will go into effect 01 July 2000. ■

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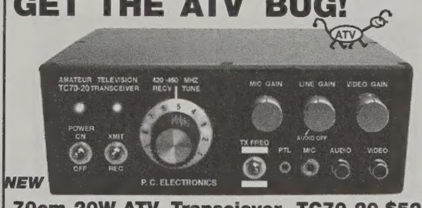

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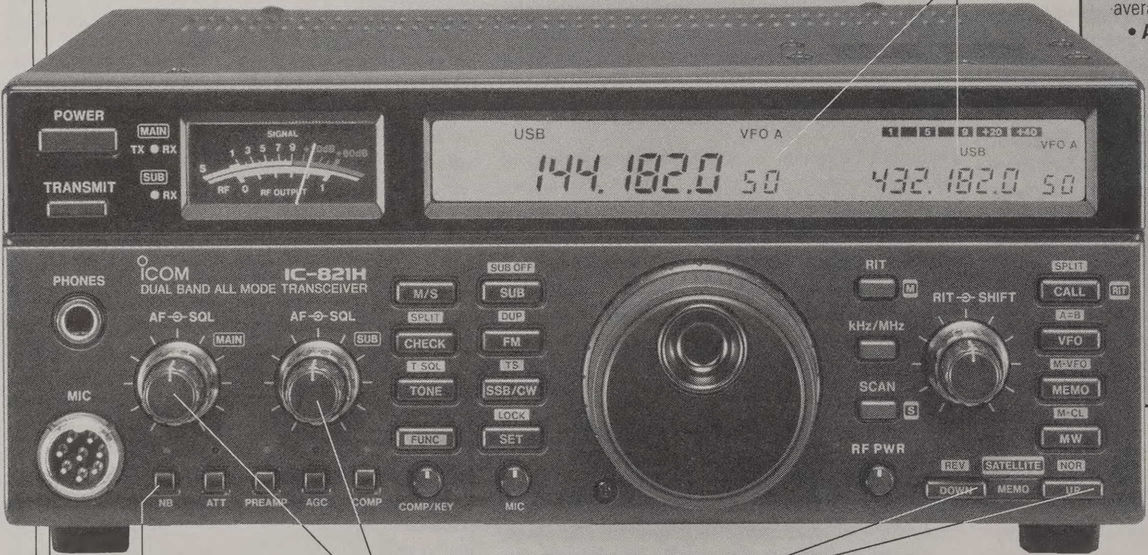

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Receive: .... 136-174 MHz, 440-450 MHz
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Mode: .... SSB, CW, FM
Power: .... 2M SSB: 6-35W, continuous
2M CW, FM: 6-45W, continuous
440 MHz SSB: 6-30W, continuous
440 MHz CW, FM: 6-40W, continuous
Power Supply Requirement: ... 13.8 V DC
Memory Channels: .... 160 Total, 80 Channels Per Band
VHF Antenna Connector: ... SO-239 (50)
UHF Antenna Connector: ... Type-N (50)
Size: .... 9.5(W) x 3.7(H) x 9.4(D) in.
241(W) x 94(H) x 239(D) mm.
Weight: .... 11.0 lb
5.0 kg

FEATURES

- **Continuously Adjustable TX Power**
  - More control
  - Extends satellite life by using minimum power
- **Independent Main / Sub Band Rx**
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  - In Satellite mode, Sub is uplink, Main is downlink
  - IF shift for either Main/Sub band
- **9600 or 1200 BPS Packet Capable**
  - Direct audio modulation
  - Excellent C/N ratio
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- **High Frequency Stability**
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